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A Wayne Green Publication

RUN

The Commodore 64 & VIC-20 Magazine

Spreadsheets: How You Can Cope with the Bottom Line

Meet TED: Commodore's Next Million-Seller?
It Will Change Your Computing Ways

C-64: In Search of the Tenth Planet

KoalaPad vs. PowerPad:
Which One for You?

Plus Serpent of Death, Mad Bomber, Baja 1000 Game Programs

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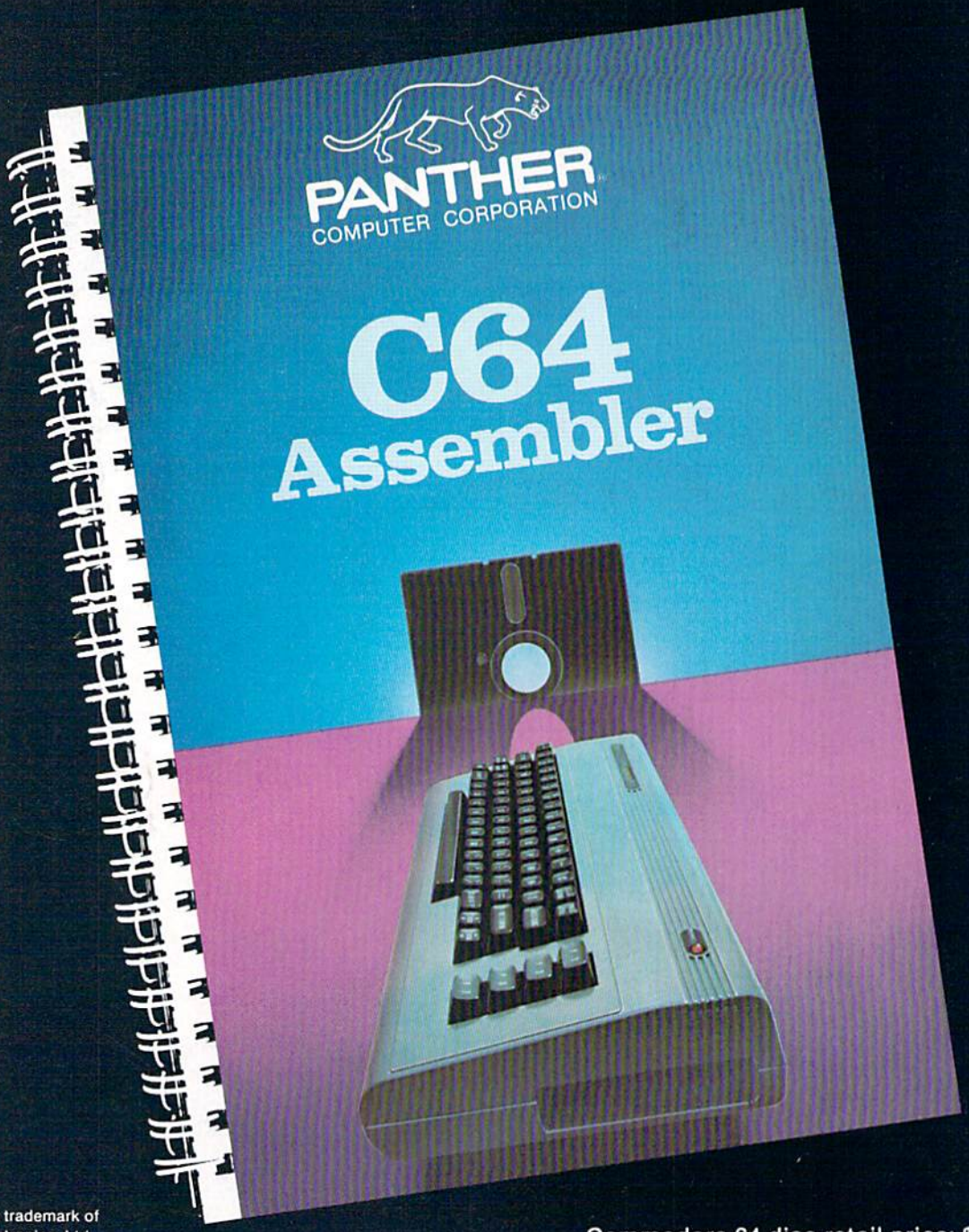

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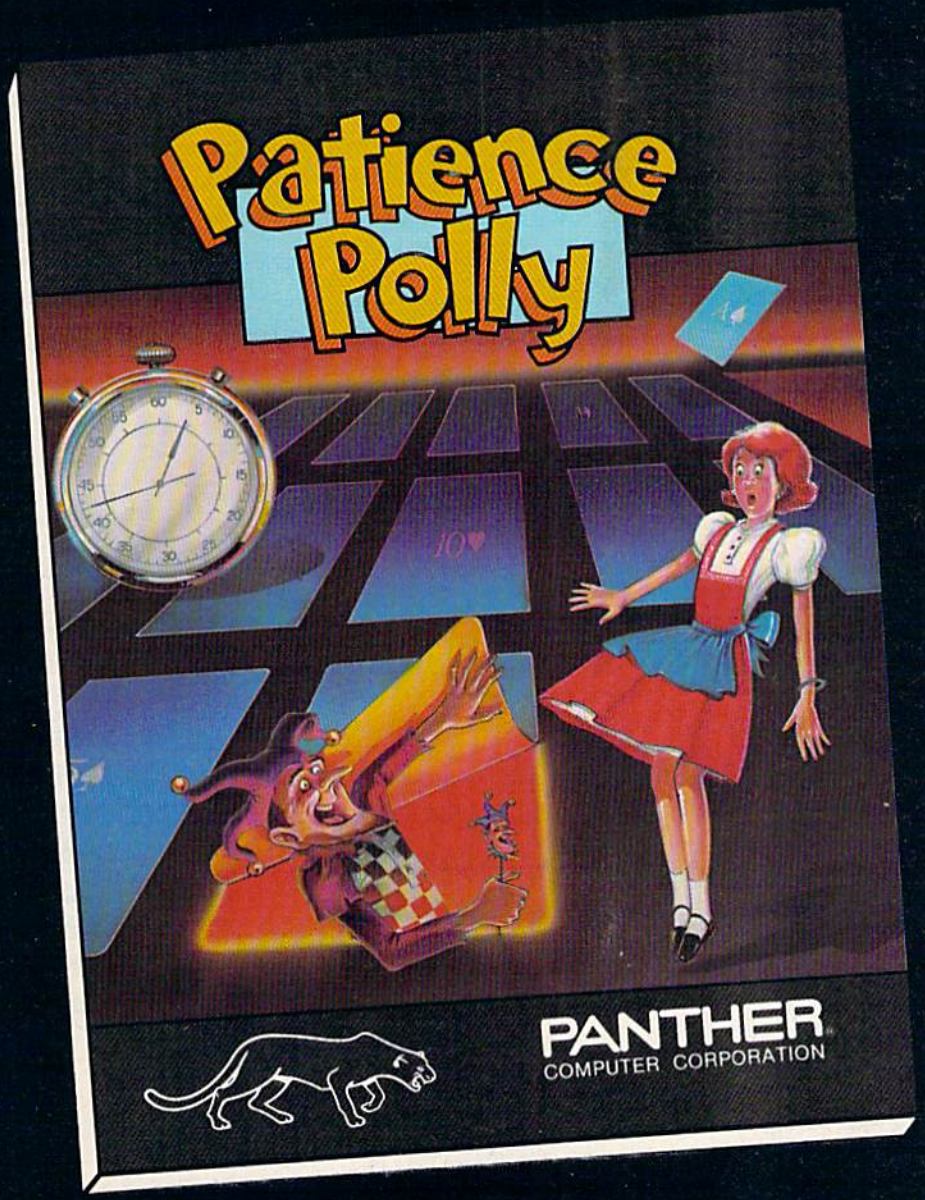

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March 1984

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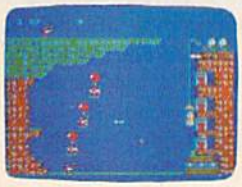

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Hello TED; Goodbye, Jack

Get Serious, Commodore

When I toured the Commodore facilities at Wayne, PA, last spring, a company official there boldly predicted, "Commodore has sold a million VIC-20 microcomputers; by this time next year, we will have sold a million Commodore 64s."

As it turns out, this Commodore soothsayer was right on the mark. In less than a year, C-64 sales have topped the million figure, and combined VIC-20 and C-64 unit sales are estimated at about 3½ million.

Today, Commodore has a new look. They are no longer headquartered in Wayne (they've since relocated in West Chester). But more importantly, the company has recently introduced a new computer that will be taking its place alongside the C-64 and VIC-20 in the stores this summer.

The Model 264, or TED (for text editing device chip), is Commodore's latest entry in the personal computer field. Although a price for this new machine has not yet been determined, it will be more expensive than the C-64, probably in the $500 range. (*RUN* columnist Tom Benford previewed a prototype of this new machine just before it was publicly announced at the CES Show in Las Vegas. His report is on page 93.)

The most interesting feature of this new generation of micros is the built-in software capability. When you purchase a Model 264, you also will choose a particular application—for example, word processing, spreadsheets, financial calculation, etc. This "software on silicon" feature lets the Commodore 264 user tailor the micro to meet his needs.

TED is being billed as the home/business applications computer for the more serious user. Forget the games for the time being; leave them to the VIC-20 and C-64. Software for the new machine will emphasize household management, word processing, calculation, business accounting and education.

Will TED take off like the VIC-20 and C-64? Commodore is betting that the built-in software feature will sell their new machine. It contains more usable memory than the C-64 (60K RAM) but lacks sprite and sound capability. The emphasis here is strictly utilitarian, helping the Model 264 user "to get more things done, more things learned and more things enjoyed in less time than ever before," according to a company press announcement.

Will Commodore be successful by opening up their line of home computers to appeal to a broader spectrum of consumers?

Well, there's very little incentive for the present C-64 owner to go out and purchase the 264. His C-64 software and peripherals won't run on the new machine without modification.

And launching a new machine will certainly cut into the sales of the C-64 and maybe even hasten the demise of the VIC-20. But I don't want to be cast as a member of the "doom and gloom" crowd.

Commodore has established a strong base of microcomputer users, and will certainly earn its share in the 1984 market, which experts predict will be 7 or 8 million units. They have exhibited a remarkable resiliency over the years, having weathered a price war and pulled themselves to the top of a savagely competitive home computer market.

Commodore has come to be viewed as a company that knows how to develop and manufacture personal computers at an affordable price. With the TED, now the more serious computer user has something to smile about.

db

Tramiel Steps Down

Jack Tramiel, president of Commodore International, has stepped down from his post as commander, owner, in-

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spiration, brains, backbone and founder of CBM.

He had been thinking about it for some time, and each landmark that Commodore achieved brought the day closer when Tramiel felt he could go on to other things, according to a company spokesperson. With Commodore's announcement of 1983's billion-dollar year, Tramiel finally decided that the company could stand on its own feet.

There is no doubt that Tramiel will still have pointers and suggestions every now and then, but for the next few months he plans to revisit many of the thousands of people and places that he has been to in the past 25 years.

Tramiel's successor will be Marshall F. Smith, president of Thyssen Bornemisza Inc. He will assume the post of president and chief executive officer Feb. 21.

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How to type listings from RUN Magazine

Typing in listings can be difficult enough without having to worry about strange graphics characters, charts or tables. That's why we decided to make it easy to enter listings from RUN by translating everything we thought might be confusing in any program.

When you see something between the curly brackets, all you have to do is press the keys indicated. For example:

{SHIFT L}—means hold down the shift key and press the L key at the same time.
{COMD J}—means hold down the Commodore key (it is on the lower left side of the keyboard) and press the J key at the same time.
{SHIFT CLR}—hold down the shift key and press the CLR/HOME key.
{HOME}—press the CLR/HOME key without shifting.
{CTRL 6}—hold down the control key and press the 6 key.
{FUNCT 2}—function 2 (in this case, you hold down the shift key and press the function 1 key).
{CRSR UP} {CRSR DN} {CRSR LF} {CRSR RT}—these are the four cursor directions.
{UP ARROW}—means the arrow key (the one with the pi sign under it).
{LB.}—the British pound sign (£).
{PI}—the pi sign key (π); (shift and press the up arrow key).

In some instances, when a large number of characters or spaces are repeated in a listing, we will represent them this way: {22 spaces} or {17 CRSR LFs}.

We hope this system will make it easier to enter the listings without having to remember or refer to any charts or conventions. If you have any suggestions as to how we might improve the system to make it even easier, drop us a letter.

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Compiled by Louis F. Sander

Magic

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Note: MAGIC's tricks are numbered in hexadecimal for your edification.

Most of this month's tricks were submitted by readers of RUN*'s premiere issue, which hit the newsstands at Thanksgiving. Within a week, our P.O. Box was overflowing with cards and letters. As you will see, some of your fellow* RUN*ners are ingenious souls, in the same class as Merlin, Blackstone, or Houdini. If* they *can do it, so can you—write up your tricks and send 'em in.*

We are especially looking for material from club newsletters, and from diverse geographical locations. Useful short programs are also of special interest, and the shorter the better. Powerful one-liners are most eagerly sought. A one-liner is any program that can be entered as a single program line. (That limits it to 80 characters on the C-64, or 88 characters on the VIC-20. Keyword abbreviations are acceptable, but the best *one-liners don't stoop to that.) How long do you think it will take us to get a trick from every state? From every continent? From a ship at sea? Not* too *long, I hope!*

We receive many duplicates or similar tricks, so don't get upset if "your" idea shows up with someone else's name on it. Take it as proof that great minds run on parallel tracks, and as a challenge to be first next time.

We try to test each trick we publish, but that's not possible in every case. (Usually it's because we lack a piece of equipment.) When we haven't tested a published trick, we'll try to let you know.

We also work very hard to avoid typographical errors. All but the longest programs are keyed in from the typeset proofs, then run to see that they work as printed. Nature being what it is, errors are bound to creep in, and when they do, we'll print corrections.

$20 Scrolling Stars—A nice scrolling effect for graphics or games can be achieved by the following short program:

```
10 A=RND(1)*23
20 PRINT SPC(A)"*"
30 FOR T=1 TO 40:NEXT
40 GOTO 10
```

The time delay in line 30 can be changed to produce a different speed. For the C-64, change the 23 in line 10 to a 40.

Geoffrey Muehlberger
Atlanta, GA

$21 More Scrolling Stars—The previous trick can be done as a one-liner:

```
10 FOR I=1 TO 66:A=RND(1)*23:PRINT SPC(A)"*":FOR T=1
TO 40:NEXT T,I
```

In this version, the 66 controls the number of stars printed; you can change it to any number you'd like.

Matthew C. Perry
Newport, RI

$22 Super Expander—Super Expanders are not always compatible with the custom characters and other programs for the unexpanded VIC. With the following few Pokes entered before a program is run, you never have to remove or disable the Super Expander. Better yet, make it the first line of every program. For two-part programs, place it in the *second* program:

```
POKE 51,0: POKE 55,0: POKE 52,30: POKE 56,30: POKE 646,6
```

What's more, none of the extra memory is affected. It's also "harmless" for the unexpanded VIC. (Untested.)

Robert M. Bleich
Graham, WA

$23 Delay Loops—To put time delays in programs, I prefer using the internal time clock to a For-Next loop. By using the TI function, I know just how long the delay will be. For example, for a two second delay, use two program lines like these:

```
310 T=TI
320 IF TI<T+120 THEN 320
```

To get a shorter or longer delay, change the 120 to a smaller or larger number. Every difference of 60 will make a one second difference. Use 30 for a half second, 90 for 1.5 seconds, 180 for three seconds and so on.

Some other uses I have found for the time function are:
(1) Control the length of time something is left displayed on the screen.
(2) Control the amount of time allowed for input when using the GET statement.
(3) In some game or education programs, calculate the length of time required for input and give a score for speed.

Ed Heinen
Bison, KS

$24 Repeating Keys—on C-64 or VIC, POKE 650,128 makes all VIC or C-64 keys repeat, just like the cursor keys. POKE 650,127 disables repeat of all keys, including cursor and space. POKE 650,0 returns things to normal, which means that repeat is enabled on Space bar, CRSR UP/DN, CRSR RT/LEFT, and INST/DEL keys.

Rob Jacob
Jones, MI

$25 Cold Starting—To cold start a VIC-20, use SYS 64802. To cold start a C-64, use SYS 64738. (Cold starting is the same as turning the computer off then on but saves wear and tear on the hardware.)

Scott Killen
Charleston, SC

$26 Headings—Here's how you can make a heading at the beginning of a program when you list it:

```
0 REM ""[DELETE][RVS ON]TTTTTT[RVS OFF]NOW TYPE THE
HEADING
```

Douglas J. Coffman
Portage, MD

$27 Screen layout aid—Having trouble laying out your graphics on the screen, or designing a sprite that looks like what you want it to? Try taping a piece of waxed paper or tracing paper in front of your monitor, and drawing directly on it what you want to reproduce graphically. You can still see through the paper, and can position your characters behind the lines you've drawn.

Bruce Jaeger
St. Paul, MN

$28 Keyboard hint—If you're not an excellent typist, odds are that the most used key on your keyboard is the INST/DEL key. Take one of those self-adhesive rubber feet that are sold in electronics stores, and stick it on top of the INST/DEL key. Now you can stab for it blindly, and hit it any time, *without* accidentally hitting the CLR/HOME key!

Bruce Jaeger
St. Paul, MN

$29 Function keys—Using the function keys can be greatly simplified by setting string variables equal to the CHR$ codes early in the program. When you need the function keys later on, all you have to do is use the proper variable.

For example, put these lines at the beginning of the program:

```
10 F1$=CHR$(133):F3$=CHR$(134):F5$=CHR$(135):F7$=CHR$
   (136)
20 F2$=CHR$(137):F4$=CHR$(138):F6$=CHR$(139):F8$=CHR$
   (140)
```

Then, when you use a Get routine, it can look like this:

```
1000 GET A$: IF A$="" THEN 1000
1001 IF A$=F1$ THEN xxx
1002 IF A$=F2$ THEN yyy
1003 IF A$=F3$ THEN zzz, etc.
```

This technique helps reduce errors and debugging time, since you enter the character codes only once, and the numbered variables make it easy to tell which function key triggers which program branch.

Landon White
Des Moines, IA

$2A Cassette tapes—Always use C-5, C-10, or C-20 cassette tapes for your computer programs. These short tapes are especially made for computers, and if you lose the tape, damage it, or expose it to something magnetic, you won't be losing as many programs as you would if you used 30, 60, or 90 minute cassettes.

Greg Osysko
Palatine, IL

$2B Debugging tip—When you get an ?ILLEGAL QUANTITY ERROR in Data statements, just put a temporary Print statement between the Read and Poke statements, like this:

```
10 READ A: PRINT A: POKE I,A
```

When the program hits the illegal quantity, you know that the last value printed is the bad one. Then you can easily locate the problem and repair it, without searching through all the Data statements.

Roy McMahon
Imperial, PA

$2C Typing tip—To avoid the woozy feeling you get when looking back and forth from keyboard to magazine when typing in a long program listing, and to cut down on mistakes from losing your place, use a voice-cassette recorder. Read the program into the recorder slowly and distinctly, then play it back and type in the program as you read it to yourself!

Karen Rhodes
Orange Park, FL

$2D List disable—At times you may write a program that you don't want listed by other people. Perhaps you are a teacher and don't want your programs listed by students. There is a magic REM statement that does this.

On the first line that you don't want listed, put REM [shifted L]. When it tries to list the shifted L, the computer will display ?SYNTAX ERROR and return to the Ready mode. The person might then try to erase the line. To prevent this, put other important statements on the same line before the REM. For example:

```
10 A=7768:B=2:REM[shifted L]
```

If the person erases the line, the program will not work properly. (To be *really* tricky, try combining this idea with the one in trick #26!)

Rick Wyman
Hampden, MA

$2E Debugging tip—When "crunching" programs, it is possible to put together a keyword and a variable name that will form another, unwanted, keyword. If this occurs, you will get a syntax error. In order to avoid this, you need only put a space between the letters forming the unwanted keyword. For example: IFC=FORC=BTHEN 100 should be IFC=F ORC=BTHEN100, and FORI=STOP should be FORN=S TO P

Mark Dancheck
Whitehall, PA

$2F VIC video—On some TV sets with automatic fine tuning, the screen will flutter when the computer is turned on. Try POKE 36864,133 to stop it. In many cases, this will stop the flutter immediately.

Thomas Ulatowski
Caledonia, NY

$30 Abbreviating zero—When a variable is assigned the value zero, such as in the statement A=0, the zero character can be replaced by a decimal point! The computer will interpret the decimal point as a zero, and will evaluate the expression about 20% faster than if you had used the zero character.

You can use this trick wherever a zero is needed by itself, but not when the zero is part of another number, like 1000.

The Transactor

$31 Bytes—A byte is the elementary unit of computer storage, and can be thought of as equivalent to one character. A kilobyte, or K, is 2^{10} bytes, or 1024 bytes. A megabyte is 1024K, or 1,048,576 bytes.

There are about 2000 characters on a double-spaced typewritten sheet of paper, so we could store all the information on such a page in about 2K bytes of memory. One floppy disk in a Commodore 1541 drive can hold about 175K bytes, or the equivalent of about 88 double-spaced typewritten sheets of paper. Many hard disk drives can hold 10 megabytes of information, or about twice as much text as in the King James Version of the Bible.

Computer Kindergarten
Pittsburgh, PA

$32 Subscripted variables—When using subscripted variables such as A(4), the operating system automatically reserves 11 elements without having to declare a dimension with DIM. (Elements 0 through 10 inclusive.)

If, however, you are short of memory and are using fewer than 11 elements per variable—say four—it will save memory if you dimension the array. For example:

```
10 DIM A(4),C$(3)
```

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Commodore Clinic

By Jim Strasma

Commodore Clinic is a regular monthly column designed to help you, the RUN *reader, through any troubles or questions you have as you use your new VIC or 64 computer. Send questions to:*

Jim Strasma
1238 Richland Ave.
Lincoln, IL 62656

(Also include a stamped, self-addressed reply envelope if you would like a personal reply.)

Q: How compatible is my PET computer with the C-64 and VIC-20 systems covered in *RUN*? Can I make use of your magazine?

Dr. Randall
Federal Way, WA

A: According to PET expert Jim Butterfield, about 85% of the information written about one Commodore computer also applies to all other Commodore models. The major changes that occur involve the locations within the computer that control events, not the events themselves.

Apart from your PET lacking the 64's chips for color, sprite and sound, and the differing locations, everything in *RUN* should be *adaptable* to your PET. Better yet, so long as programs avoid 5 key Basic commands (Peek, Poke, Wait, SYS and USR), they should run unchanged on your computer.

And even when you find those 5 key Basic commands, you may still be able to convert the program for your PET, with the help of memory maps like the one in Appendix B of Osborne/McGraw-Hill's *PET Personal Computer Guide.*

Q: What I need to know is the degree of compatibility possible between the VIC or 64 and the CBM 8032. Could I buy 64 programs and run them through the 8032 by adjusting the 8032 memory map? What could I try today?

Harold Barnes
Baton Rouge, LA

A: Programs that avoid the "Big Five" commands listed above, will run on your 8032 with a bit of help. First, run Chuan Chee's program "CBM 4032," available from most user groups. This will turn your 8032 into a 40 column machine, until it is next turned off. Then enter:

```
POKE 2048,0:POKE 41,8
```

If you haven't already loaded a 64 program, also enter the New command. From then until you turn off the machine, it will run compatible 64 programs.

To go the other way, run the PET emulator on the Commodore bonus pack disk, available from your dealer. For 80 column programs, you will need an 80 column adapter program or cartridge.

Q: Each time that I adjust my RCA model UGM2032S TV/Monitor for a color picture from my VIC, I see an annoying amount of "tearing" on the left side of the screen. The computer is connected directly via cable, rather than through the antenna connections. Any suggestions?

Michael Herman
New York, NY

A: It is fairly common for VICs to have a slightly untidy top left border when used with a regular TV, but usually not with a monitor. To isolate the problem, try the VIC with a couple of other monitors, of differing brands. If they work well, the problem could be in the RCA. (A *Consumer Reports* review of a large RCA TV last year mentioned it didn't work well with the VIC.)

An RCA repair service may be able to adjust the monitor. There is also an adjusting pot inside the VIC that might make a difference. Before tinkering, be sure you know how to put things back as they were, and that your warranty has expired.

In general, if two pieces of computer gear must work together, test them together before buying. Many of the better dealers will let you test computers and TVs together in the store before purchase.

Q: Where can we get a true RS232 adapter for the 64?

Fran Turco
Vienna, VA

A: Commodore's own RS232 interface, the VIC-1011A, works fine on both the VIC and 64. It plugs into the user port, just like the VICModem, and terminates in a DB-25 female connector for RS232.

Its voltage levels are high and low enough to work with nearly all RS232 equipment, and 11 of the 25 pins are used—enough for most hardware handshaking requirements. An area dealer reports he's had trouble getting it for several months, but the local K-Mart recently had two for under $50.

Q: What is the Poke to change cursor blink speed on the 64?

Dennis Hallingstad
Sparta, WI

A: To do this, you'll need to copy the system's ROM chips into RAM memory. Then Poke 59965,X, where X is the desired cursor blink delay. (On older 64s the equivalent location is 59964.) On either one, the desired location normally contains a 20. Replacing it with a bigger number will make the cursor blink more slowly and a smaller number will make it blink more often. Regardless of how quickly the cursor blinks, it will move no faster than 60 times per second. That is how often the

keyboard is checked by the hardware of the computer.

Here is a simple routine to copy the ROMs into RAM:

```
100 FOR I=40960 TO 49151
110 : POKE I,PEEK(I)
120 NEXT
130 FOR I=57344 TO 65535
140 : POKE I,PEEK(I)
150 NEXT
```

Then, after you have made the changes you want, turn on the RAM copy of the ROMs with Poke 1,Peek(1) and 253.

To restore the original ROMs afterwards, use Poke 1,Peek(1) or 2.

Q: What is the Poke for the Control key that makes listings slow down when it is up and fast when it is down?

Dennis Hallingstad
Sparta, WI

A: To do this, you'll need the system's ROMs into RAM again, as explained above. Then Poke 59721,240. (It normally contains 208.) This modifies the Scroll routine, which controls the speed of listings, along with the speed of anything else that is printed to the screen.

To give something like the desired effect on a VIC, you must change the high byte of the interrupt clock. This slows down listings (among other effects). Try Poke 37159,10 or less. Poke 37159,66 restores normal operation.

A better approach would be to buy a commercial programmer's aid package that allows you to scroll listings in both directions. Then the speed is entirely up to you.

Q: I have an Okidata 110 printer, connected to my VIC 20 through the user port by a Data 20 interface. When I use the Quick Brown Fox text editing cartridge, the only way I can get a printout is by changing the device number from 4 to 2.

Can I change the interface's switches so the VIC will think device 2 is device 4?

Richard Roberts
Niles, IL

A: I doubt if switches can help you. On the VIC and 64, device 4 is defined in the Kernal ROM as going to the serial bus, and device 2 is defined as going to the user port, just as device 0 is the keyboard and device 3 is the screen.

Nothing you can change from the keyboard will help after you turn off the computer to plug in your text editor. Your best solution may well be to get a printer interface that plugs into the serial bus.

Q: Which printers will do C-64 graphics? How is it done?

Kenneth Benson
Columbia, SC

A: The only full-sized printers that do Commodore character graphics properly without any fuss are Commodore's own dot matrix printers: the MPS801 and 1525, or, via an IEEE-488 interface, the 8023 and 4023. These do the 64's character graphics automatically.

Next best is a printer and interface designed to do Commodore graphics, but it's not from Commodore. Among these, the Epson FX-80 and Gemini 10x printers are notable for their ability to download entire character sets, and the new Cardco "Card/?+g" and Tymac "Cable Brains" interfaces similarly allow Prowriter and Gorilla brand printers, respectively, to fully emulate a Commodore 1525. Either approach allows adequate emulation of Commodore's graphics characters.

Q: I heard a strange whooshing sound as the directory was loaded. Things went downhill with the disk drive from then on. Do you suppose using the backside of the disk could have injured the disk drive?

Anne C.S. Phillips
NJ

A: I expect your "whooshing" sound from the 1541 was its flywheel rubbing against the bottom case. It's a very common 1541 fault, sounds awful and takes no more than a small hammer to fix, once you get the case off with a Phillips screwdriver. If that's the problem, double-sided disks have nothing to do with it. To keep the flywheel from coming loose again, service techs now superglue it in place, and current 1541s have an added screw, to keep it in place.

Q: What is the Poke for reverse scrolling on the 64?

Dennis Hallingstad
Sparta, WI

A: The easiest way to get reverse scrolling on program listings is to buy a

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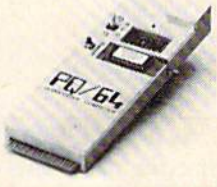

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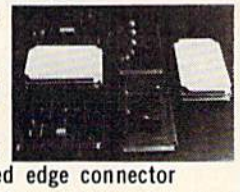

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programmer's aid which includes that feature. Those with it include Sysres-64 (from Solidus International), Power 64 (from Pro-Line Software) and VIC Tree (from Skyles Electric Works).

The following listing will scroll anything on the screen down. It is slow, but could be converted into machine-language for more speed. (Also feel free to delete REMs, spaces and spare lines.) The sequence of events is: 1) find the start of the screen memory and color memory; 2) calculate the end of screen minus one line; 3) poke the contents of each location one line down; 4) erase the top line.

```
100 REM SCROLL DOWN/64
110 W=40
120 SS=256*PEEK(648)
130 SO=55296-SS
140 FOR I=SS+960 TO SS STEP -1
150 : POKE I+W,PEEK(I)
160 : POKE I+SO+W,PEEK(I+SO)
170 NEXT
180 FOR I=SS TO SS+39
190 : POKE I,32
200 NEXT
210 RETURN

100 REM SCROLL DOWN/VIC
110 W=22
120 SS=256*PEEK(648)
130 SO=37888+256*(PEEK(648) AND 2)-SS
140 FOR I=SS+484 TO SS STEP -1
150 : POKE I+W,PEEK(I)
160 : POKE I+SO+W,PEEK(I+SO)
170 NEXT
180 FOR I=SS TO SS+21
190 : POKE I,32
200 NEXT
210 RETURN
```

Q: Does anyone have a screen dump program to use with the C-64 and the Epson FX-80, using the CXC401-B interfact from ECX Computers?

Connie Archambault
Meriden, CT

A: Cardco Inc. includes a high-resolution screenprint program suitable for the Epson MX-80 printer with Graf-Trax in the manual for its Card/? interface. It'll also work on the FX-80, which recently replaced the MX-80, and I imagine it will also work on your ECX interface. Cardco has also released a new "+g" model that allows the FX-80 to directly print Commodore graphics.

Q: My son and I are very interested in using the VIC to control electro-mechanical devices like Tandy's new Armatron robot arm. Are any interfaces available?

C. R. Hawley
Kansas City, MO

A: The book *PET Interfacing* (from Blacksburg Press) can help. It tells how to use the user port to control several on/off switches. The addresses will differ for your VIC, but the concepts are the same. Plan on using the user port, suitably buffered, to control micro relays, which in turn can control solenoids to move things.

Unfortunately, Armatron's control is entirely mechanical. There are no internal solenoids or other electronics to patch into. Your solenoids will have to make the same motions your fingers do in contolling the arm—no easy task.

You do have a hardware wizard in your area—Rick West, SYSOP of the Kansas City PET Bulletin Board, 816/356-2382. Perhaps he can help you.

Q: Is there a real flippy floppy made for a 1541? I recently bought some double-sided disks. What would be the problems if they were punched to use both sides on a 1541?

Herb Gross
Elgin, IL

A: Such a disk was advertised briefly last year. However, it cost nearly as much as two regular disks, and seems to have disappeared. The problem with such schemes is that the disk will sometimes rotate in one direction and sometimes in the reverse direction. This will tend to increase wear, as dirt trapped by the cleaning pad while rotating in one direction is thrown back onto the working surface when rotation is reversed. This technique is only suited to disks that will see very limited use.

Q: I have been looking for Genealogy programs for over a year, and the only thing I find is that they are scarce as hen's teeth, especially for the VIC and 64. I would appreciate finding something in *RUN* on the subject.

David W. Kelley
Middleton, MA

A: While waiting for someone to send *RUN* a good article on the subject, you might want to request a sample copy of *Genealogical Computing*, a bi-monthly newsletter published by Data Transfer Associates (5102 Pommeroy Drive, Fairfax, VA 22032). You might also try *Family Historians' Forum*, a modem bulletin board, at 703/978-7561. R

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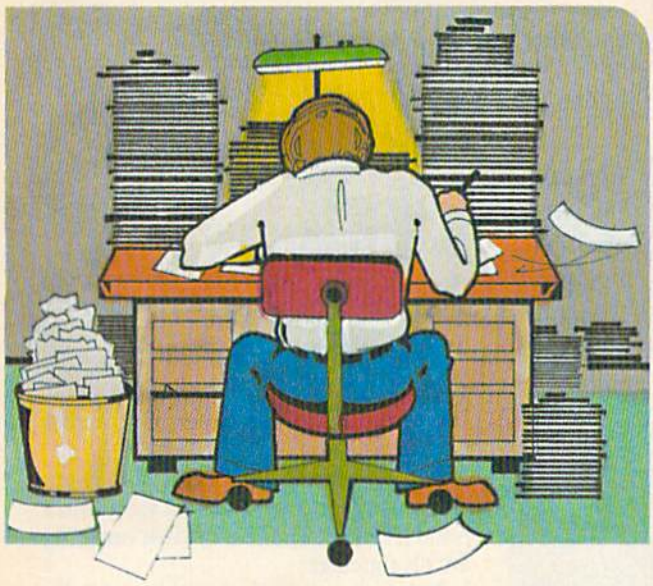

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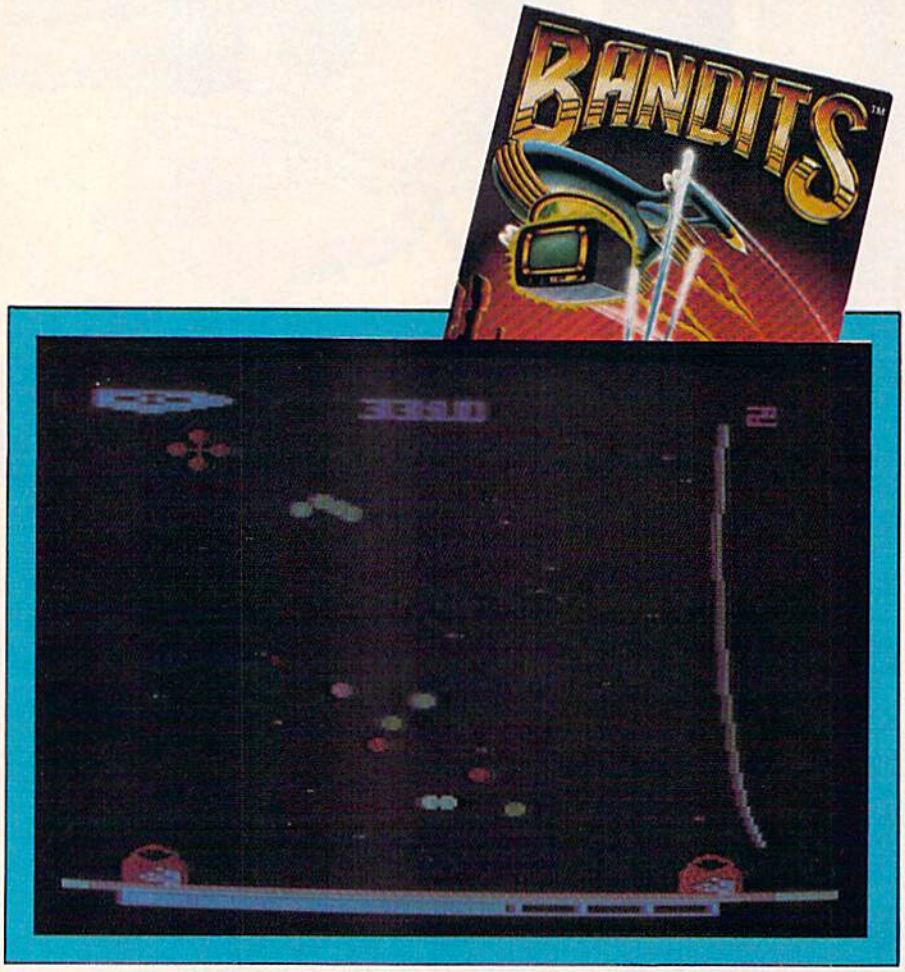

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E—Poor.
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Bandits

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A

Once in a while an original game comes along that merits special attention. Sirius Software has released such a game whose interesting and challenging features rank it at the top of the shoot-'em-up genre.

In Bandits, for the VIC-20 cartridge (also available for the Commodore 64), a variety of colorful attackers plague you. Your mission is to defend a lunar supply depot, warding off alien thieves that swarm above you, raid your storehouse and transport stolen loot across the sky.

If you blast the bandits while they are carrying stolen loot, you will score extra points, but the chances of their escaping are also greater.

This game combines the best of Invaders and Centipede to give you hours of enjoyment. There are five types of bandits you must contend with.

Enemy fire consists of heat-seeking bullets slicing through the sky, striking from varying angles, as opposed to vertical paths down. The bandits are keen sharpshooters; your fighter most dodge quickly to elude them.

Bouncing shapes, like tennis balls, are released in bundles cascading down, jumping and rolling for a few seconds on the ground. Until each one of 'em disappears, you must avoid the deadly spheres—even at ground-level. A fine variation.

Joystick or keyboard directs your defender right or left. Button or space bar activates your mobile laser gun.

Speedy shooting demolishes the enemy and scores points. A splendid graphics display of gliding forms resembling parachutes weaves across the sky, dropping bombs. You can activate a protective shield to defend your fighter from the onslaught. However, your protection only lasts for a limited time, so you must activate this device with care.

One complaint: some of the bombs blend into the star-laden background. The sky scenario, while realistic, offers a confusing degree of distraction. Not a serious problem, however.

Bandits is shoot-'em-up game action at its best. For the game player who wants a challenge, Bandits is a steal at any price. *(Sirius Software, Inc., 10364 Rockingham Drive, Sacramento, CA 95827. $39.95.)*

John DiPrete
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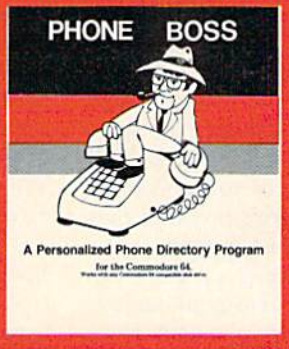

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The Blade of Blackpoole

Sharpen Your Sword For High Adventure On Your C-64

B

I've been playing adventure games since Scott Adams came out with his first one for the TRS-80 over five years ago. Things have come a long way since those days. The Blade of Blackpoole (Sirius Software, Inc., 10364 Rockingham Drive, Sacramento, CA 95827. $39.95) is one of a new breed of adventure games available for the Commodore 64.

Microcomputer adventures can cause strong reactions in some people. Some people love them, while others can't stand them. For those of you who enjoy a good adventure, here's one that may tempt your adventurous appetite.

Blade of Blackpoole is a good, challenging adventure. It weaves an interesting story set in a medieval world. Your goal is to recover a mystical sword and return it to the altar from which it was stolen. As you travel through the land, you encounter a variety of hazards and puzzles. The solutions to these puzzles are not always easy to find, but they are logical.

If you're an adventurer, you know perfectly well that there are different types of adventure players. The purist will play only a text adventure—he spurns the trappings of color and graphics. I must admit that for a time even I was such a snob. But to be honest, I really did enjoy the sensory experience of Blade of Blackpoole.

It offers a very nice graphic display on the top half of your screen, with a scrolling text display below. The pictures are faithfully rendered in pleasing color. Although this is not an animated adventure, items do appear and disappear as you drop them and pick them up again.

Sometimes things are hard to identify from the pictures. However, all objects that can be taken are listed in the text below the graphics, preventing any major headaches. Most of the time, I had no difficulty telling where I was and what surrounded me.

One annoying problem was that of disk accesses. Each time I traveled to a new location, the disk was accessed to obtain the graphics data necessary to draw the new scenery. Although this was no great problem at first, it did tend to slow things down later when I was familiar with the territory. The blame cannot be placed upon Sirius, however. We Commodore owners know that we have some of the slowest disk drives in the industry, and for the most part we have become accustomed to it.

All the glitter and glamour of color graphics cannot disguise a poorly constructed adventure. It is the challenge of the adventure that is really the measure of the game. One needs to consider just how effective the game would be if it were stripped of the graphics. Does it succeed on its own merits, or does it need the graphics for a crutch? Blade of Blackpoole succeeds on its own.

The game has many of the things that all adventurers expect in a good adventure. For one thing, you can save your place in the adventure. Originally, this feature was included in games as an aid for playing multiple sessions. You could save your place before turning off the computer and going to bed. You could later resume the adventure without starting back at the beginning.

Today, however, this feature is frequently used (or misused) to save your place before taking some potentially dangerous action. If you are killed, you needn't start over from the beginning. This game allows you to save up to ten different scenarios on disk.

Another convenience that adventurers expect is the ability to use abbreviations. Blackpoole allows you to use all the frequently used shortcuts, such as N for "GO NORTH." Also, you are not limited to only two words when you need to express a more complicated command. You are permitted such sentences as "MOVE THE ROCK WITH THE LEVER."

There were a few things that I did not appreciate, however. When I found myself in a dead end, which occurred with regrettable frequency, I had to quit and start the game over by loading it into the computer again. It's a big game, and that took a distressing amount of time. It was especially frustrating when I was anxious to try a new strategy. I quickly found that a faster way was not to quit, but rather resume from a previously saved position.

Another problem that I found was the lack of a vocabulary list. This is a common problem in many adventures. It becomes apparent when you want to do something, but can't find the words that the computer understands.

A simple solution that some adventures use is to provide a list of verbs that the program recognizes. This in no way allows you to cheat, but rather takes the frustration out of such situations. Blade of Blackpoole has no such command. I wish it did.

Is this the ultimate adventure? Of course not. I've seen talking adventures with digitized voices. Others have music and sound effects. Some have animation (even the clouds float by). But this one doesn't have to try to compete with them. It is a good, solid adventure on its own merits.

Do I recommend this adventure? It depends upon who you are. If you are one of the diehard text adventurers, you probably would not be converted by this game. If you like only arcade games, I doubt if this will convert you either.

But if you are interested in trying a

graphics adventure, this would be a good one to try. I liked it and would like to try some of Sirius's other adventures.

John Olsen
Newberg, OR

Delta Drawing

This Electronic Game Replaces Lincoln Logs And Lego Sets

Remember those truly special Christmas toys you received as a kid—the kind Mom and Dad spent hours "explaining" to you (because they really enjoyed playing them too)? Spinnaker's Delta Drawing program reminds me of the Lincoln Log or Erector sets of past years—or the Lego bricks of today—but this electronic game of creation is even more fun.

Why? Because Delta Drawing is a uniquely interactive drawing and coloring program, one a four-year-old or a teenager could easily enjoy. The user selects his own level of complexity, drawing little squares and triangles or designing a complex and riotously colorful fireworks display. As you learn, the program grows with you and you're always in charge: that little "turtle," or pointer, on the screen can't do anything unless you tell him to do so. What a feeling of power!

How does Delta Drawing work? You start out by drawing simple figures with your pointer, pressing L for left and R for right and D for draw or U for a 180 degree U-turn. You can draw a triangle by typing in 2R, 7D, 4L, 7D, 4L, 7D. Then you learn to save your creation by pressing S, later calling it back with an X1, X2, X3, etc.—you can save as many as nine individual drawings or programs at once.

After mastering the basics, you step up to making complicated polygons, and Spinnaker's outstanding and detailed manual tells you exactly how to make circles and complicated figures and how to repeat patterns. Using a building-block approach, you can create primitives of circles, squares, etc., later calling them back as needed. Or use the Kaleidoscope command (K),

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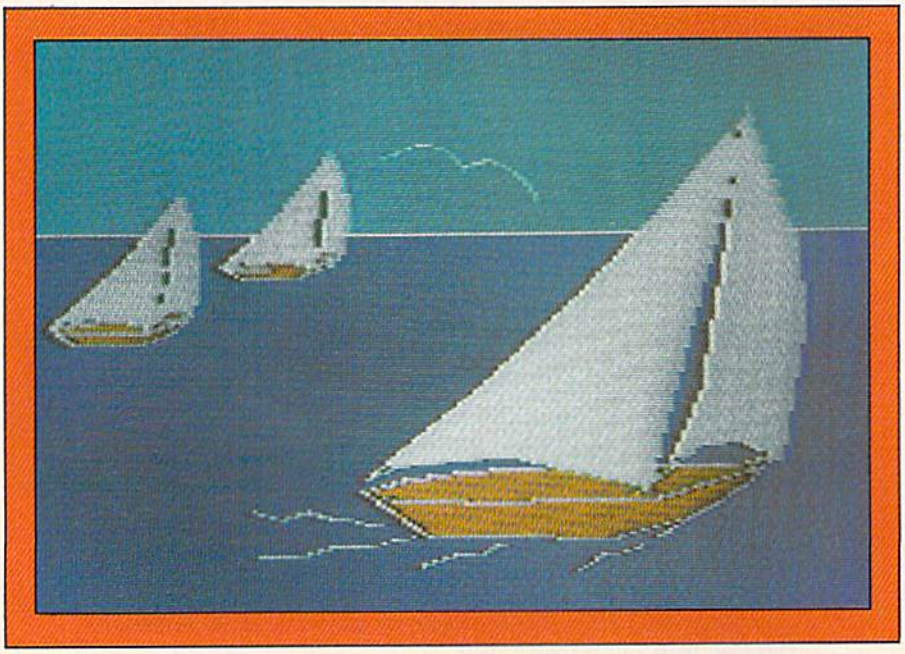
As a fun educational tool, Delta Drawing is a must for school and home.



and call up four pointers! (You can use this mode to draw a butterfly.) Try the programs in the manual and create a boat, a maze or other figures. Or, you can make up your own designs—it's your choice.

Learning is very sneakily embedded in the program—as you create, you're actually writing a very simple program, and at any time you can call up the text by merely pressing T. So you can create either by programming in the T mode or by drawing in the G (for graphics) mode.

After your child masters basic drawing, he's ready for the color. Pressing C generates three basic colors: green, white and blue. Control C gives you eight hues! He'll learn to fill in the shapes, by getting that pointer inside a figure and pressing the Control F keys. Then move on to another figure, Control M, and fill in its shape with a different color! Your child may also change the color of the background should he so desire.

Your child can design his own little house, fence, flowers, trees—the choices are endless, because the turtle moves however you want him to, not just in a straight line. And if you make a mistake, you can press the E key to erase your last few instructions, or Control E to erase the entire picture.

Another great feature of this software: if you have a tape system, you can save your gorgeous masterpieces from cartridge to tape. If you have a printer, you can print out your child's creations for posterity. The manual gives simple and explicit instructions.

I gave my five-year-old son (who can't read) basic instructions and left him for a few minutes to try it out. But when I came back he had lines repeating themselves and strange exotic patterns all over the screen! At first he didn't know what he was doing, he was merely experimenting. But after a short while, he began learning through his trial-and-error method, repeating commands and showing *me* how to reproduce his designs!

This is his favorite program and he can spend a solid hour creating and destroying his graphics. (Which is an extremely long time when you're five!) He doesn't understand the text mode at all, although he has called it up a few times and stared at it quizzically. Here's where an older child would benefit, a child of reading age who can program on this simple level.

I like Delta Drawing because it uses the computer as a tool, unlike the boring drill-and-practice exercises so much educational software still relies upon. The program also very successfully conveys to the child that learning can be fun and exciting, not just a dreary chore to be gotten through. And the colors on the C-64 are beautiful, lending themselves perfectly to this program.

Delta Drawing is a very good at-home program, because your child can play it for five minutes or an hour (or more). But a schoolteacher might want a child to "share"—very difficult to do in this case. Could you share coloring one page of a coloring book? Would you want to? Also, while he's at home, the child's time probably won't be limited to blocks of thirty minutes or so; instead, he can take his time. (Would Renoir have been willing to stop after a half hour?)

I strongly recommend Delta Drawing to every parent. It's a great confidence-builder because the child not only admires what he's drawn, but his parents can also reinforce him. You'll be amazed at how quickly children grasp this program.

Delta Drawing is not only educational, it's also highly entertaining. But one warning, Moms and Dads of America: please tear yourselves away for a few minutes and give Junior a chance to play with it! *(Spinnaker Software, 215 First St., Cambridge, MA 02142. $39.95.)*

Christine Adamec
Palm Bay, FL

VIC FORTH

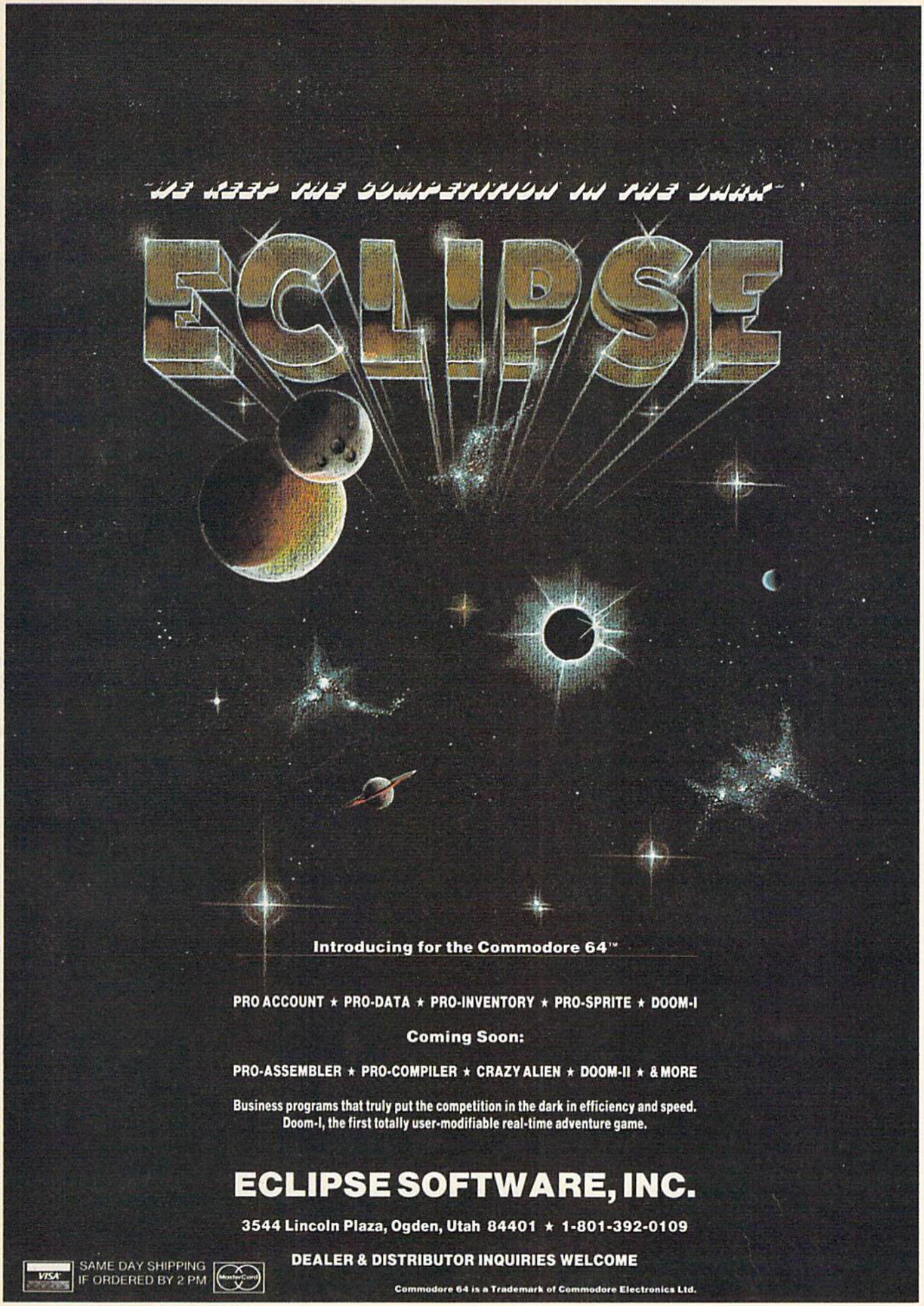
This "System" Will Excite The Skilled Programmer And New-Language Explorer

B

VIC FORTH is a FORTH programming system produced by Human Engineered Software (71 Park Lane, Brisbane, CA 94005. $49.95). The software is supplied in cartridge form and plugs directly into the VIC-20 expansion connector. It will run in an unexpanded VIC with about 3K bytes left for the user. Any extra memory (excluding a 3K expansion cartridge) added to the computer will provide more user-available memory.

For those of you unfamiliar with FORTH, a few words of explanation are in order. I refer to FORTH as a system because it is much more than a programming language.

Every FORTH system contains an interpreter, a compiler and a text editor.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VIC FORTH lets you add new commands and create your own customized programs.

The entire user interface, including the editor commands, is standardized. When we speak of compiling in FORTH, we mean compiling into an intermediate—and more compact—representation of FORTH code. This is the code that is executed by the FORTH interpreter.

Word-Building Power

The most powerful aspect of FORTH is the ability to add new commands (called words) to the language. These new words are placed in the "dictionary" and execute just like standard FORTH words. Programs are written by defining new words. Ever more complex functions are built from previous definitions, until the entire program is a new FORTH word.

Simple programs can be written in the immediate mode. More complex programs can be saved and modified using the text editor. Most commands execute in exactly the same way, whether entered in the immediate mode or executed from a stored program.

VIC FORTH is an almost complete implementation of a popular version known as FIG-FORTH. (FIG is an acronym for FORTH Interest Group.) Since the VIC-20 is usually used with cassette storage, all the disk-related commands are missing from the language. However, the ability to add new words means that you can add the commands required to save programs onto disk. The instruction manual shows exactly how you do this.

While some of the standard FIG-FORTH words are missing, some new ones have been added. They allow you to take advantage of capabilities specific to your VIC-20. For example, one-word commands can be used to access each of the sound registers. There are also words to control the user port and the screen and border colors.

An important aspect of any programming system is its text editor. The standard set of editing commands in FIG-FORTH are line edits. While VIC FORTH contains most of the standard editing commands, I find that I rarely use them.

The VIC version has an additional screen-editing mode that allows you to position the cursor to insert and delete characters. The VIC's editor is much easier to use than the FORTH standard.

There is one unfortunate aspect of the editor. A standard screen in FORTH is 64 columns by 16 rows, while the VIC display is 22 columns by 23 rows. In making a compromise, the author of the software chose to allow the full 64 characters across.

But the VIC screen is a 22-character window that moves across the full 64-character screen under control of the cursor keys. This means that the whole screen can never be displayed at once in the edit mode. In the normal mode, lines wrap around the screen as usual.

Most professional FORTH systems contain an assembler; VIC FORTH does not. The maximum 8K allowable memory space for a ROM cartridge is simply not big enough to pack in a complete FORTH editor, interpreter *and* assembler.

Provision is made, however, for linking to machine language programs written with a separate assembler. Like the 22-character display, this is a limitation of the VIC-20, not the software package.

Custom Designing

When I first started using VIC FORTH, I found some things, like the missing commands, annoying. But, as I said before, one of the most powerful aspects of FORTH is the ability to add new commands to the language.

After a short time with VIC FORTH, I had written my own customized utility program, which I run immediately after power up. It defines new commands that I like to use, redefines some existing commands, changes screen colors and takes care of all my pet peeves. FORTH encourages customization in programming, and in that respect, FORTH is what you make it.

The instruction manual included with the software is complete in the sense that it contains a list of all the available FIG-FORTH commands. If you are an experienced FORTH programmer, you will have no trouble using this implementation.

FORTH, however, is quite different from Basic and most other computer languages that I know. If you are new to FORTH, be prepared to shell out money for at least one other book about the language.

A few pages into the instruction manual, you will encounter this sentence: "If you are a complete beginner to FORTH, you should probably skip this section for now, and go to the book *Starting Forth*, which you should have purchased."

All in all, VIC FORTH is a good software package. Whether VIC FORTH is worth the price to you depends on what you like to do with your computer. If you purchased your computer because you enjoy programming and exploring a new language, it will be well worth the price.

If you are new to FORTH, however, be aware that it will take some time to become proficient in the language. The price of VIC FORTH is somewhat higher than the average VIC-20 cartridge, but I find that I spend much more time "playing" FORTH than I ever will shooting at aliens.

John Tanzini
East Windsor, NJ

Benji's Space Rescue

This Canine Caper Out in Space Is for Kids and Parents Alike

Can learning actually be fun? We're "mature adults" (sensible and experienced, not old!), but as we look back to our school years, we remember best what we learned in courses that combined learning with fun. And now as parents, don't we look for programs that effectively achieve for our own children that elusive blend of information and entertainment? Benji's Space Rescue (Human Engineered Software, 150 North Hill Drive, Brisbane, CA 94005. $39.95) is clearly one piece of software that incorporates elements

of learning and playing, and does it very well.

This is a game of space travel and adventure, with information about the solar system embedded in the program. The premise is relatively simple, reminiscent of the old Star Trek type games played on many a mainframe. A space mission must be accomplished with limited time and resources available, and with adversaries lurking behind every planet! But Benji's Space Rescue is as different from those early space adventure games as the warp drive is from impulse power.

When you start the game, you're placed in command of the spaceship Woof, with faithful dog Benji as your trusted assistant. After you've selected your level of difficulty (ranging from pilot officer to fleet marshal), the computer displays your mission.

You have a certain number of days to rescue the scientists. (There are a specified number of scientists, with more of them on the higher levels.) These trapped intellectuals may be anywhere, from Mercury to Pluto, and you'll have to help Benji find them.

But before you go anywhere, you must fuel up and arm yourself with torpedoes. (You get phasers and shields automatically.) At the lower levels of difficulty, Benji takes care of the mundane tasks of uploading fuel, food and the torpedoes needed to accomplish your mission. But as you become more proficient, these housekeeping tasks become *your* responsibility along with coping with reductions in your ship's reserve capacity.

For example, at the lower levels, you can load on extra fuel and torpedoes with no problem, but as you progress to higher levels of difficulty, you're far more limited. It's also worth noting that on the higher levels the scientists themselves begin to count heavily as "cargo," so you may have to dump some fuel or torpedoes to make room for them.

The program displays your command console, from which nearly all ship operations are conducted by simple joystick movements (or the keyboard, if you prefer). By moving your joystick, you can issue commands to the transporter room, engine room and so on.

The graphics and sound in this game are superb, from the initial depiction of Benji and the theme song (played in three-part-harmony!) to the sights and sounds of the Woof entering and leaving warp drive, avoiding meteor collisions in the asteroid belt, to the beaming up of the little figures of the scientists. The Red Alert sound grabs your attention!

One particularly beautiful graphics display is of the planets, which can be called up individually for information on their characteristics.

One particularly beautiful set of displays is the high-resolution graphics of the planets, which can be called up individually for information on their characteristics. For example, the game provides facts about Saturn and its rings. We learn that scientists think Saturn's surface is composed of liquid hydrogen and that the atmosphere is extremely turbulent, along with other facts and figures.

Should the Woof get low on gas, you may need to move on to another planet to fuel up. Or if your ship gets hit, you'll have to move on to make repairs. You must make many decisions, which increase with the level of difficulty. Through all these exercises, the child learns the joys and woes of planning.

The lack of an Armageddon-type finish also makes Benji a positive experience for children. At the lower levels, if you fail completely and run out of everything, the "stasis pod" is automatically activated, and you're rescued. When you fail at the higher levels, the mission is "terminated."

Each time Benji attempts to land on a planet and rescue scientists, robot "drones" do their level best to prevent him from successfully beaming up those scientists. But the drones can only damage Benji's ship—they can't kill him or blow him up.

Important recommendation: read the manual! If you don't you'll be lost and frustrated with this program. Benji's Space Rescue includes a demo-mode for you to run through and we do mean "run"—it's a little too rapid for the novice.

Adults might find it difficult to relate to a cute little dog saving the entire universe, but the program really wasn't written for grown-ups (it's intended for ages eight and up). Our five-year-old son, although young for this program, loved it; he instantly identified with the dog as a good character and a friend. We've turned him loose on the program, and he frequently runs out of fuel and food, neglecting to save any scientists, but he also now knows the names of all nine planets and has asked many questions about them.

This is an excellent program to help children learn about the planets, spatial relationships and good planning. Yet watching Benji and his spaceship zoom through asteroid belts and zap drones is a lot of fun. Is it educational? Is it a game? It's both, and we recommend it to parents.

John and Christine Adamec
Palm Bay, FL

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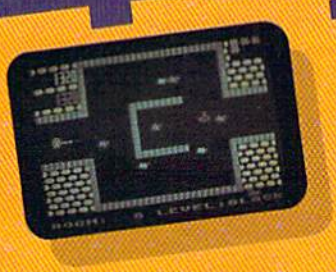

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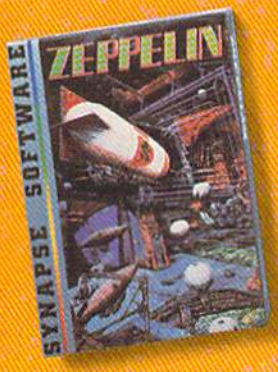

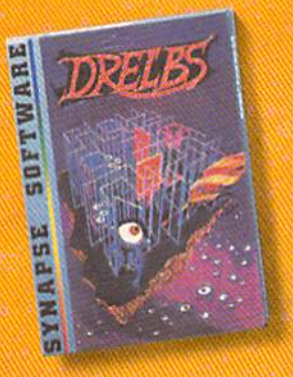

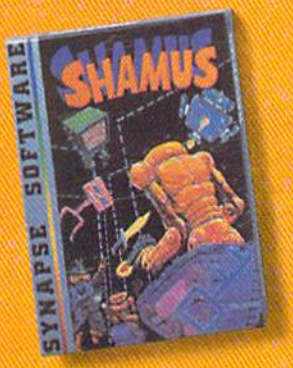

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For Gamesters Only

By Tom Benford

Hi, Gamesters! In this column, I'll be covering lots of games for the VIC-20 and Commodore 64, strategy tips to improve your scores, add-ons (peripherals, in computer jargon), tech tips and news items to further the enjoyment of your Commodore!

I'm looking forward to sharing these items with you each month, and I want to hear from you—write to me with your questions, comments and items of interest. Send your letters to:

Tom Benford
PO Box 125
Osborneville, NJ 08723

Each month I'll review games that are bound by a common subject, such as combat, mazes, pinball, adventure and so forth. The games I reviewed in this month's column are war-oriented. So don your fatigues, grab your joystick and set your sights on realistic combat adventure....

Computer Wars

(VIC-20 Cartridge from Thorn-EMI, 1370 6th Ave., New York, NY 10019; $39.95.)

Computer Wars is loosely based on the hit movie War Games. The scenario is a take-off. A home computer hacker has broken the entry code into the main computer at NORAD (the North American Air Defense System) and has accidentally triggered a simulated nuclear missile attack. NORAD's computer, unaware that it's only a simulation, has initiated a counter-attack, aimed at the U.S.S.R., with real nuclear warheads.

As chief console programmer, you must seek out and destroy the simulated missiles on "the big board," while trying to find the correct combination to abort the attack program on the "little board."

To assist you on this mission, the playfield shows a map of the U.S., which depicts our missile silos; white dots represent approaching enemy missiles. The joystick enables you to position the cursor over the simulated missile that poses the greatest threat to our silos.

The fire button changes the display to give you a close-up look at that part of the country, and directional arrows show the approaching enemy missile's direction. Lining up your sights with the missile, you must track and home-in on it, then blast it from the air.

This portion of the game is crucial; failure to obliterate an enemy missile triggers a retaliatory launch of our missile, which initiates global thermo-nuclear war and results in Armageddon. Also, you are racing the launch countdown clock, so you have to track and destroy in a minimal amount of time.

Once you've destroyed an enemy missile, you must use the joystick and fire button to abort the launch of our missiles and match the pattern on the "little board." Once again, failure to abort brings us closer to global destruction. Successful code-matching brings you back to the "big board" to track and destroy another enemy missile.

The game's graphics are good; the sound and play-action is fair. The instructions seem a bit complicated at first, but after a few plays you'll get the hang of it and achieve better scores.

The game is very frustrating, however, since a winning score is 10,000 points, which can only be achieved by tracking and destroying all enemy missiles in minimal time—and that's darned near impossible! I haven't achieved that yet, and I'd like to hear from any of you who have; I'd also like to see a snapshot of the screen showing your victory. This game is definitely for those who enjoy a continuing challenge!

Strategy Tips

When playing Computer Wars, first go for the missiles closest to our silos, as these pose the greatest threat. After homing-in with the cursor, follow the directional arrows on the screen and position the enemy missile directly in the "V" of your sights and continue firing until it is destroyed. Remember that time is of the essence, so try to zero-in on your targets as fast as you can.

When you're breaking the code on the "little board," the fire button changes the match-pattern; do this while moving the joystick around quickly and you stand the best chance of finding the correct combination. Good luck!

Submarine Commander

(VIC-20 Cartridge from Thorn-EMI, 1370 6th Ave., New York, NY 10019; $39.95.)

In Submarine Commander, you're the commander of a sub that is cruising the Mediterranean and searching for convoys of enemy ships. A convoy is usually made up of four ships: a patrol boat, destroyer escort, destroyer and tanker. You must destroy the tankers to cut off the enemy's fuel supply, but you'll have to contend with depth charges and enemy fire from the convoy's warships.

Your sub is equipped with a map, sonar, periscope, hydrophone and torpedoes, plus the added ability to submerge and surface, which enables you to launch surprise attacks on the enemy convoys. Gameplay is achieved through use of both keyboard and joystick, or may be initiated through the keyboard alone (I've found that the combination of stick and keys works best).

Submarine Commander offers nine skill levels, and the average game will take from 12 minutes to 1 hour, depending on your skill as a commander and the skill level you select.

The playscreen provides you with lots of information about your sub and its condition; your instrumentation includes an attitude gauge, depth gauge, speed indicator, compass (for course

bearings), time clock, torpedo supply, fuel supply, battery charge indicator, air supply, hydrophone and damage indicators. The sub's speed is selected via the keyboard using keys 0 (stop) through 9 (18 knots), and the sub travels fastest when it's on the surface rather than submerged.

The P key activates the periscope screen, which only works at a depth of 30 meters or less. The torpedoes can only be fired from a depth of 25 meters or less. The S key activates the sonar screen, and the M key displays the map, which shows the positions of the sub and the enemy convoys.

A time clock keeps track in actual time of how long each game takes; the elapsed time affects your rating as a commander, which is given at the end of the game.

Level one consists of four enemy convoys. It takes a few plays to become proficient at using all of the sub's controls and instrumentation, but that's part of the fun. The instructions supplied with the cartridge may at first seem a little complicated, until you become more familiar with the game.

The game is basically silent except during battle—then it's very realistic, with depth charges shaking the video display and the sounds of explosions.

The sonar display, sounds and the explosions of a torpedo scoring a direct hit on the enemy are incredibly realistic. The graphics, which provide a realistic representation of the submarine's controls, are also very good.

The play action—stalking the enemy and engaging in battle with the convoys—is exciting. What I liked best, though, is the cunning, stealth and strategy required to surprise the convoys, destroy the enemy ships and escape with a minimum of damage to the sub. Steering the sub while coordinating the most effective speed and depth may not be every gamer's cup of tea, but if you enjoy a realistic combat adventure, then Submarine Commander is a must for your gaming library!

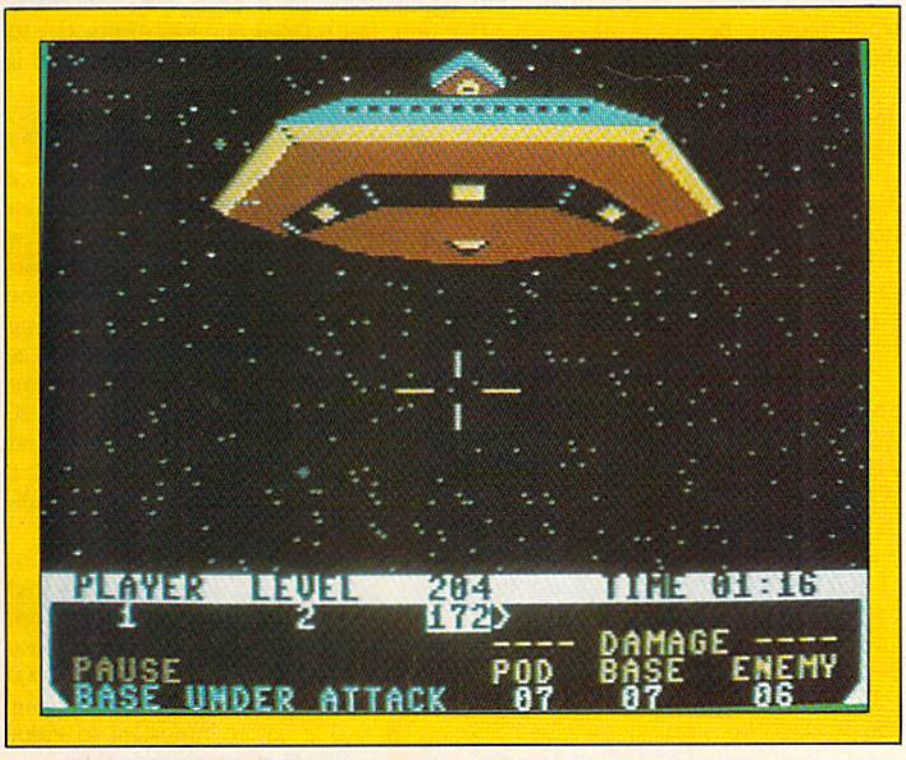
Strategy Tips

Your overall rating as a sub commander will be based on several factors: number of enemy convoys sunk, torpedoes used, fuel used, damage to the sub, total tonnage sunk, time taken to complete the mission and other factors.

Damage to the sub causes the heaviest penalty, so you should avoid this at all costs. Attacking while surfaced leaves you most vulnerable, and diving deeply helps you in most instances when the enemy is dropping depth charges. Be careful when diving, though, or you may beach the sub on an underwater sandbar or mountain, in which case you will forfeit the game.

You can minimize counter-attacks by firing torpedoes from a distance, but the target enemy ships are harder to hit this way. Retreating during a depth charge attack is your smartest move, and if the sub sustains any damage, repairs are completed fastest while it's on the surface.

You shouldn't launch an attack until repairs are completed or the sub is functioning at 75 percent or better capacity. The game may take a little longer this way, but at least you'll have the necessary weaponry and instrumentation when it's needed most—in battle. Happy hunting!



Neutral Zone promises hours of gaming fun for C-64 owners.

Neutral Zone

(Commodore 64 disk or cassette from Access Software, 925 East 900 South, Salt Lake City, UT 84105; $34.95.)

This game for the C-64 is outstanding in every respect—graphics, animation, resolution, sound effects, play action and challenge-level. Superb! Congratulations to Bruce Carver for his superb programming on Neutral Zone.

Alpha IV is an early-warning station located on the edge of the Neutral Zone. You're the pilot of an interstellar combat ship, and your job is to protect Alpha IV from marauding alien vessels that seek to destroy the base and stop the transmission of intelligence information on their activities.

You maneuver the ship's gunnery pod with your joystick, and you fire its laser cannon with the fire button. Directional finders alert you to the approach of enemy ships, and your mission is to line them up in your cross-hairs and destroy them before they attack the base or your ship.

Neutral Zone has five play levels and can be played alone or with two players. Level 1 pits you against ten enemy ships that seek to destroy the base only; level 2 has 20 enemy craft that fire at you as well as the base; level 3 has 30, and so on. As you progress from level to level; the enemy ships move faster and become more evasive.

The base can only sustain a certain damage level before it goes into "condition red," which disintegrates it. Your craft, also, can only take a certain amount of damage, and you must evaluate both the condition of your ship and the base, making compromises where necessary to ensure survival.

At the end of a game, your perfor-

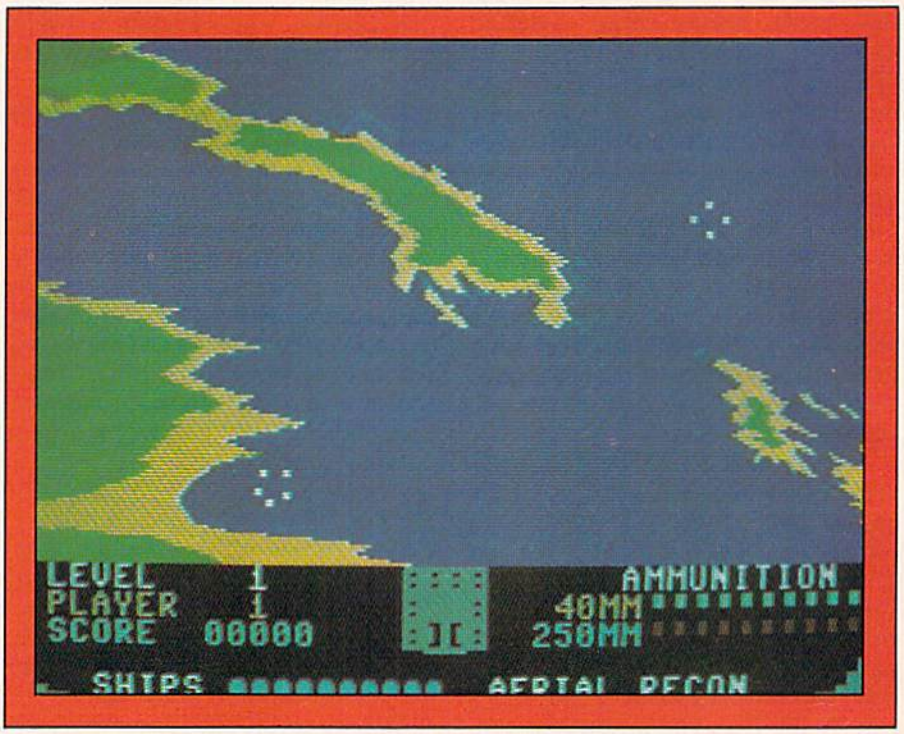
mance is rated and your score is shown. These ratings range from tourist to superman, depending on how well you've done.

Neutral Zone is a stand-out among space-combat games for the C-64, and it will provide countless hours of gaming fun for Commodore 64 owners.

Strategy Tips

Your score and rating will depend on how much damage you allowed to occur as well as how long you took to destroy the enemy squadron. Keep your eyes peeled for the earliest directional attack warning; line up the enemy in your cross-hairs and fire, then move on to the next target as quickly as possible. You'll find that aiming slightly ahead of the target will achieve the most direct hits.

On levels 2 and above, speed of firing is most crucial, since the enemy ships will fire back and damage your craft. Level 5 is crazy, and should be attempted only by the most skilled cosmic warriors out there!



Set your sights on enemy bombers in Beach-Head.

Beach-Head

(Commodore 64 disk or tape from Access Software, 925 East 900 South, Salt Lake City, UT 84105; $34.95.)

Beach-Head is, without a doubt, the most awesome disk-load game I've seen yet for the Commodore 64. This game has realistic graphics, fantastic animation, outstanding play-action and lots of options and strategies. Additionally, it's for one or two players and gives you the option of permanently recording your high scores on disk! The game's designer and programmer, Bruce Carver, really outdid himself on this one!

At the start of the game, you're given a choice of how to engage the enemy. If you sneak up on them by taking the treacherous water route, you'll have to guide your fleet through a narrow channel that's full of mines and enemy torpedoes coming at you from all directions; although hazardous, it has the strategic advantage of getting you into the enemy harbor unnoticed, so you can launch a surprise attack.

Or you can meet the enemy head-on and engage in an all-out battle with enemy bombers that attack your ships while you man the anti-aircraft guns and blast them out of the sky (hopefully). The realism of this portion of the game is unbelievable!

The next battle takes you into the enemy harbor, smack in the middle of their fleet, which fires mortar shells at your ships for all they're worth. Your primary target is the enemy aircraft carrier, which is worth 10,000 points, but you'll have to be quick—it moves off the screen in a few seconds.

Also, you'll have to change the elevation of your gun sights to increase or decrease your range as you fire at the enemy ships—each will be at a different distance, and since the distances are randomly generated by the program, no two games will be the same. You must sink the entire enemy armada before progressing to the next level, the land battle.

The land battle has your fleet landing on the enemy beach-head. Each surviving ship in your fleet carries two tanks, which are now unloaded on the beach. While evading heavy artillery fire from the enemy, you must guide your tanks, one at a time, through a perilous course of obstacles and mine fields. The course becomes more hazardous with each tank lost, so your lead tanks have the best chance.

Once you've negotiated the course, you reach the enemy fortress, the game's final level. The fortress has several gun emplacements that have to be knocked out in rapid succession before the massive cannon draws its bead on you. Speed and accurate aim are critical here, and if you're successful, the enemy waves a surrender flag.

Anyone who achieves a surrender can be very, very proud; this is one game that demands a keen eye, concentration, fast reflexes and lots of practice to master. But be warned: Beach-Head is not only great, it's addictive as well!

Strategy Tips

Practice, persistence and experience will account more for higher scores than anything else, but I can offer you a few pointers. When undergoing the air attack, conserve your shots. The enemy planes are extremely hard to hit at long distances, but much easier to blast as they approach. Try to knock them out before they fire at your ship, since 20 units of damage will sink a ship, and you'll need all your ships to stand a chance at completing the game full-term.

Aim for the fuselage (body) of the enemy aircraft. The slower-moving red aircraft that saunter across the sky from time to time are only reconnaissance aircraft. While they're worth 2000 points each, they won't bomb your ships, and it's more important to shoot the bombers that attack your fleet.

In the sea battle, when you fire at the

enemy ships, a white splash indicates your range is too short, and you should elevate your guns. No splash indicates your range is too far, and you should lower your guns. Each degree of elevation changes the hit distance by hundreds of feet, so don't move too much without firing a test shot. The faster you can ascertain the distance of your enemy targets, the better are your chances of proceeding onto the land battle.

In the land battle, concentrate on avoiding the mines and obstacles, which are booby-trapped, and fire only at enemy artillery emplacements that can't be avoided. Zig-zagging will help you avoid getting hit.

The fortress is a real can of worms. As each gun-port turns white, aim and fire as quickly as possible, since misses allow the enemy cannon to draw a bead on your location.

Remember, this game will take lots of practice and concentration to master, so keep your cool and aim straight!

Archon

(Commodore 64 Disk from Electronic Arts, 2755 Campus Drive, San Mateo, CA 94403. $40.00)

How would you like a game with the strategy and concentration of chess, the romance and lore of Dungeons and Dragons and the combative action of battle? How about a little magic, too? If so, Archon is for you!

Archon is a depiction of the forces of good and evil, of light and darkness in their timeless struggle to annihilate each other and conquer the five "power points." Both sides are equal in number, although the play pieces (or "icons") are not identical; their strength, however, is balanced. Game play is designed for two players, or one player against the computer. Play-action is achieved through the joystick and fire button.

The icons of the game are steeped in mythology, with such Gnostic characters as phoenixes, djinnis, trolls, basilisks, dragons, manticores, goblins, banshees, unicorns, golems, valkyries, knights, archers, shapeshifters, wizards and sorceresses abounding.

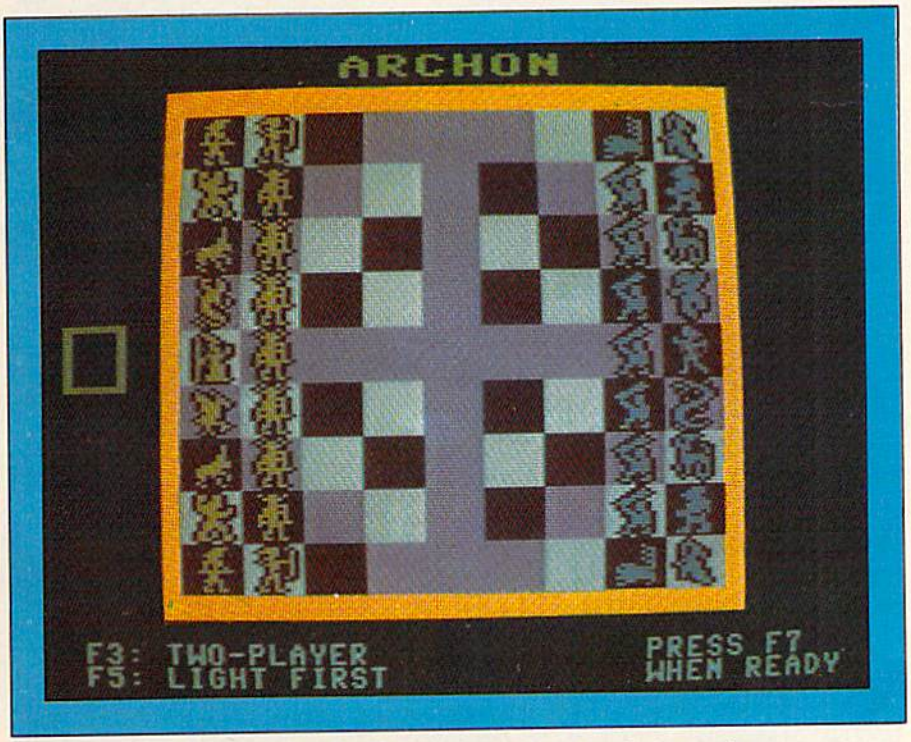
The game is played on two screens: strategy and combat. The former shows the position of all play pieces, and you and your opponent (human or computer) move them about in turn to gain a strategically favorable position. The latter is the arena in which the two pieces battle for possession of a particular square in question. Unlike chess or backgammon, the defending piece on the square is not quietly removed if defeated—much too docile for Archon. If you desire a particular square on the strategy board, you'll have to satisfy your gaming "bloodlust" by fighting for it in the combat arena.

The appeal of Archon is twofold. First, it offers the cerebral satisfaction of a strategy game, such as chess. Second, it offers the player(s) the opportunity to "get down and dirty" in the battle arena. Hence, there's something for everyone here.

There are several factors that contribute to winning a game. Among them are luminosity cycles, power points, skill in the combat arena, attack intervals, barriers and wounds. Additionally, there are several spells including teleports, healing, time-shifts, summoning elementals, revival spells, imprison spells and others.

An excellent manual is supplied with the disk, and I strongly advise reading it cover to cover for in-depth explanations of each icon's power, movement and effect of spells. Archon is definitely not a game that you can just load and play—it's a complicated piece of software, and you haven't a chance if you don't understand the rules of play. It will also take quite a few practice games before you settle down and gain some proficiency at it.

Music, sound effects, graphics and play-action are all superb, as is the documentation. The game was designed by Jon Freeman, Paul Reiche III and Anne Westfall. Freeman is the author of a book on board games and played the king's pawn in a living chess match; Reiche is a physicist and contributed to the concept and play-action facets of the game; and Anne Westfall was responsible for the coding of the program as well as the one-person play option. From such diverse backgrounds, these three talented people have spawned Archon, which promises to be the definitive standard for medieval combat/computer games.

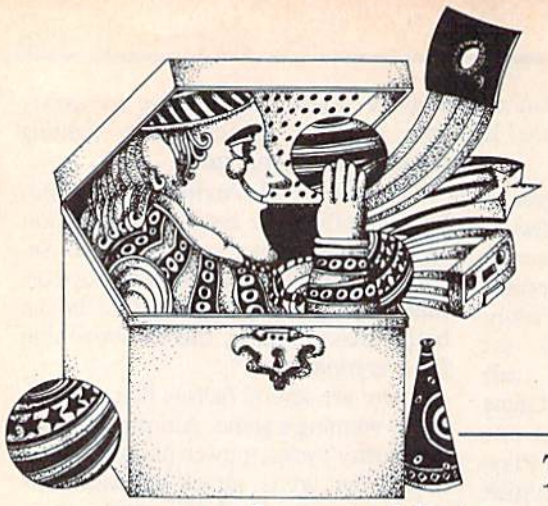


Archon—a chessboard never saw such combative action.

Strategy Tips

The best strategy tip I can give you is to gain experience in Archon and read and re-read the manual. The old addage, "knowledge is power," is the gospel truth in this game.

You must be thoroughly familiar with both your own icons and those of your opponent, understand their movement and attack patterns, and above all, play fiercely while remaining cool and calm. If that sounds like a list of heavy requirements, you're right. But then, Archon is a heavy game! R



Video Casino

By David D. Busch

This Tunnel Run program will take you on an unforgettable journey to the depths of an underground abode, where attacking aliens are determined to do you in.

Tunnel Run is an exciting chase through the subsurface depths of the planet of your choice. Your spaceship, speeding through a weird mineshaft, must try to survive the onslaught of attacking aliens. You use the joystick to move the ship from side to side as the mine and aliens scroll past.

You can choose the difficulty level—speed, width of mine shaft and number of aliens. But where did all these aliens and spaceships come from?

Most games written for the VIC-20 take advantage of its very complete graphics character set. But what if you need something that is not available—a spaceship, perhaps, or a noxious alien?

From ROM to RAM

Fortunately, the VIC-20 allows you to redefine the character set completely, with the number of new characters limited only by the memory available for them. When you press a key, the VIC-20 looks in ROM (Read-Only Memory) for information about how to form the character that it will display in response.

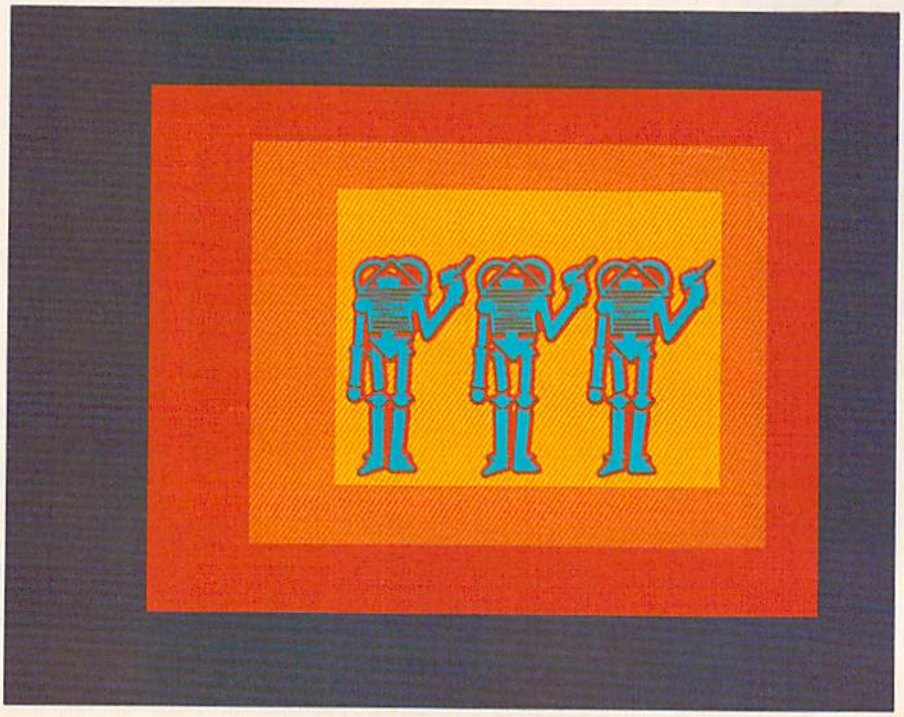
You probably know there's no way to write to ROM, and so would assume that there's no way to change this character information. That much is correct. However, there's a way of telling the VIC *not* to look in ROM for the character data, but instead to check RAM locations of your choice.

Instead of going directly to ROM, the VIC normally looks at a RAM location, 32869, to ask for directions, so to speak. When the computer is powered up, the ROM loads into this location the value of 240, which points to the proper ROM locations for the character information. Unless we Poke a different number in 32869, the VIC-20 will always go to the same place for its data.

In fact, you can change the value from the keyboard. Pressing the Commodore key and shift key simultaneously will change the computer from uppercase and graphics to upper- and lowercase mode. Then 32869 will contain 242 instead of 240. You can also do this from command mode. Try it.

Get the idea? It's also possible to put some *other* number in that register, and send the VIC looking, not in ROM, but in RAM, where you've deposited character set information of your choosing.

But you must first protect that RAM



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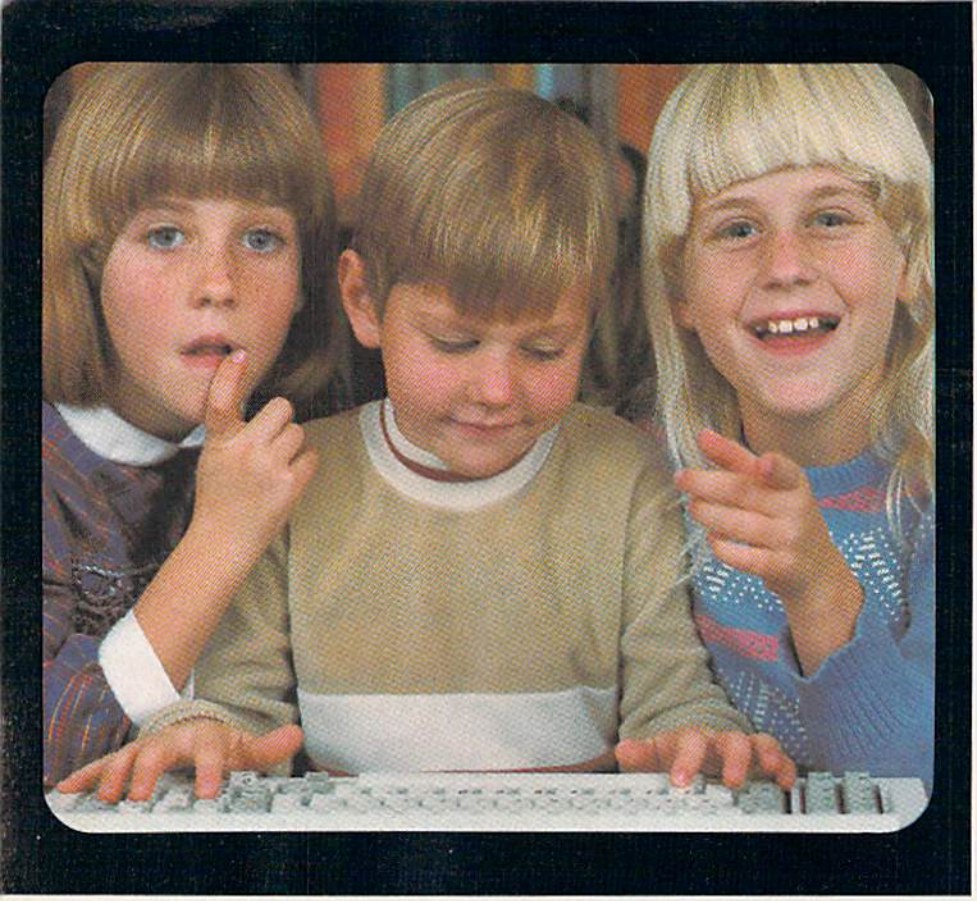

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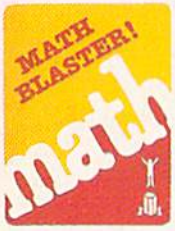

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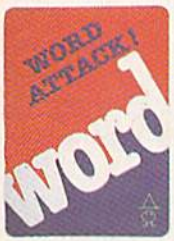

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from program interference by lowering the top of memory. This is done in lines 60–70. (Because these pointers have been altered, it is not possible to use Tunnel Run with a VIC-20 containing expansion memory.)

The usual procedure in producing user-defined character sets is first to copy all of the existing character information into the new RAM location. That will give you an unaltered version of the characters, in case you want to use some of the normal alphanumerics or graphics. The VIC-20 cannot jump back and forth between ROM and RAM for its character information, so it's necessary to provide a complete character set to use in RAM.

The copying set is carried out in a For...Next loop, beginning at line 180. The ROM character values, beginning at 32768, are Poked into RAM, starting at location 7168.

This game can be as simple or as complex as you wish— but the top difficulty level is guaranteed impossible.

Once these values have been copied over, you can change a few. This program makes use of a few unneeded characters, the @ sign, the ! and the >. These are found (in our new RAM locations) in eight bytes beginning at 7168, 7432 and 7664, respectively.

Character Building

The VIC-20 characters are constructed on an eight by eight matrix. Each bit of a byte represents one picture element in the given row. Each of the eight bytes represents one full row. It might be easier to see how each of the special characters is built. Your spaceship construction appears in Fig. 1.

Can you see the form of the ship in that matrix? The bytes for the alien and for the mineshaft walls appear in Fig. 2 and Fig. 3, respectively.

You calculate the decimal numbers in the right-hand column of each figure by converting the binary numbers, and then you list them in the Data statements of the program (lines 460–480).

First byte:	1 1 0 0 0 0 1 1	195 (decimal)
Second byte:	1 1 0 0 0 0 1 1	195 (decimal)
Third byte:	0 1 0 0 0 1 0 0	68 (decimal)
Fourth byte:	0 0 1 1 1 1 0 0	60 (decimal)
Fifth byte:	0 0 0 1 1 0 0 0	24 (decimal)
Sixth byte:	0 0 0 1 1 0 0 0	24 (decimal)
Seventh byte:	0 0 1 1 1 1 0 0	60 (decimal)
Eighth byte:	0 0 0 1 1 0 0 0	24 (decimal)

Fig. 1. The bit representation of the spaceship in Tunnel Run.

Listing 1. Tunnel Run program for the VIC-20.

```
10 REM **************
20 REM *              *
30 REM * TUNNEL RUN *
40 REM *              *
50 REM **************
60 POKE52,28
70 POKE 56,28
80 DIM S$(18)
90 FOR N=1 TO 18
100 S$(N)=""
110 FOR N2=1 TO N
120 S$(N)=S$(N)+">"
130 NEXT N2
140 NEXT N
150 PRINT"{SHFT CLR}"
160 GOSUB 850
170 POKE 36869,255
180 FOR I=7168 TO 7679
190 POKE I,PEEK(I+25600)
200 NEXT I
210 FOR N=7168 TO 7175
220 READ H
230 POKE N,H
240 NEXT N
250 FOR N=7432 TO 7439
260 READ H
270 POKE N,H
280 NEXT N
290 FOR N=7664 TO 7671
300 READ H
310 POKE N,H
320 NEXT N
330 POKE 36879,24
340 VOICE=36876
350 V1=255:V=10
360 DD=37154
370 PA=37137:PB=37152
380 A1=3:FG=1:U1=7680
390 U2=7702:U3=8164
400 POKE 36879,14
410 POKE 37139,0
420 POKE 36878,V
430 POKE VOICE,V1
440 T=1:A=4
450 TI$="000000"
460 DATA 226,164,27,40,108,176,175,132
470 DATA 195,195,68,60,24,24,60,24
480 DATA 255,129,189,165,165,189,129,255
490 T=8:A1=10
500 FOR N=1 TO 23
510 PRINT S$(4);SPC(14);S$(3);:PRINT""
520 NEXT N
```

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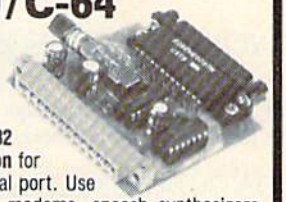
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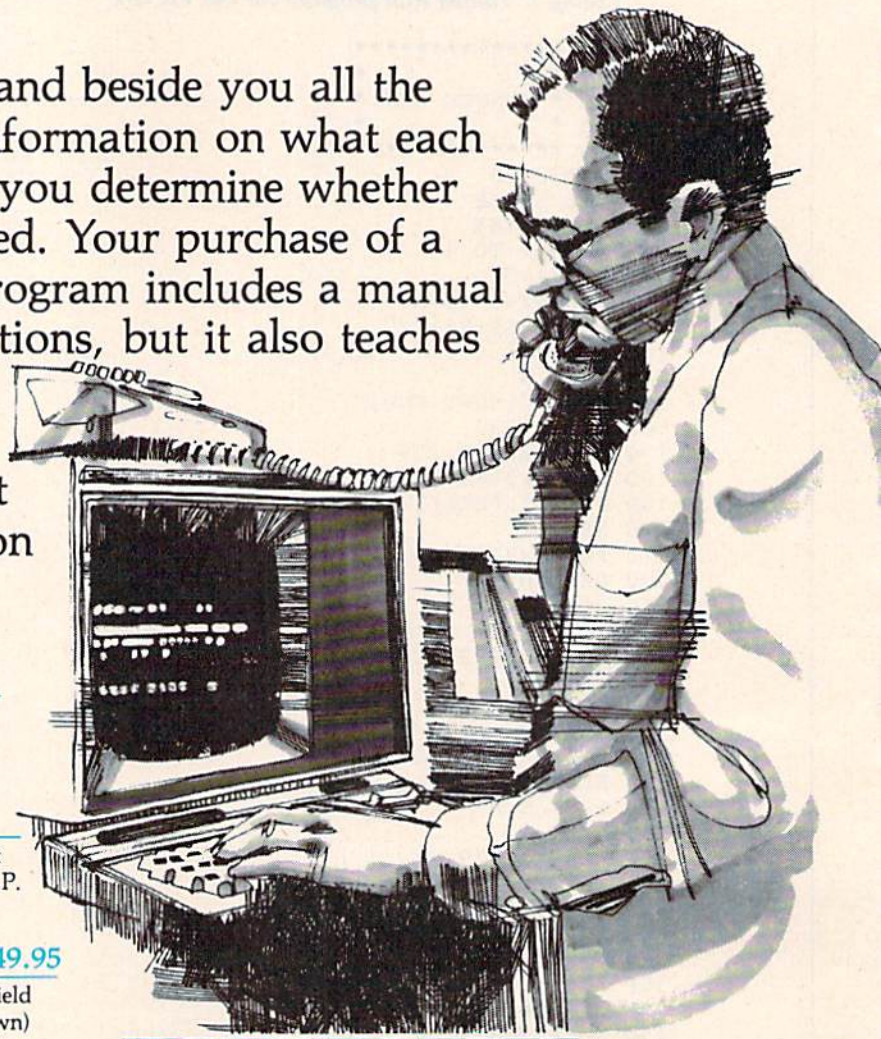

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Each Data line contains the bytes for a separate figure. You can alter the numbers to change the shape of the characters. The program makes the change by reading the data and Poking it into the RAM locations.

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Run-Through

Tunnel Run operates on a simple principle. Your spaceship is Poked to the screen at the top row, with the exact position determined by the movement of the joystick, as in previous programs. The mineshaft and the aliens are printed at the bottom of the screen. Each mineshaft or new row of aliens printed causes the screen to scroll up towards your ship. The program checks to see if the position to be occupied by your ship is a space. If not, you have collided.

Movement of the shaft to the right or left is chosen randomly, as well as the positions of aliens. You, however, select the frequency of their appearance. The game can be as simple or as complex as you wish. But—don't select the narrowest mineshaft and the fastest speed. The top difficulty level is guaranteed *impossible*! R

1 1 1 0 0 0 1 0	226
1 0 1 0 0 1 0 0	164
0 0 0 1 1 0 1 1	27
0 0 1 0 1 0 0 0	40
0 1 1 0 1 1 0 0	108
1 0 1 1 0 0 0 0	176
1 0 1 0 1 1 1 1	175
1 0 0 0 0 1 0 0	132

Fig. 2. The bit representation of the Tunnel Run alien.

1 1 1 1 1 1 1 1	255
1 0 0 0 0 0 0 1	129
1 0 1 1 1 1 0 1	189
1 0 1 0 0 1 0 1	165
1 0 1 0 0 1 0 1	165
1 0 1 1 1 1 0 1	189
1 0 0 0 0 0 0 1	129
1 1 1 1 1 1 1 1	255

Fig. 3. The bit representation of the mineshaft walls in Tunnel Run.

Listing 1 continued.

```
530 GOTO 600
540 D=INT(RND(1)*2)+1
550 J=INT(RND(1)*AL)+1
560 IF J<>2 THEN GOTO 620
570 FA=INT(RND(1)*3)+1:FA=FA*D
580 F4=T+INT(W/2)+FA
590 IF F4>T+W OR F4<T GOTO 620
600 IF F4=PR GOTO620
610 POKE U3+F4,0
620 PR=F4:IF D=2 THEN D=-1
630 IF T+W+D>18 GOTO 660
640 IF T+D<1 GOTO 660
650 T=T+D
660 GOSUB 720
670 POKE VOICE,0
680 PRINT S$(T);SPC(W);S$(21-W-T);
690 PRINT""
700 POKE VOICE,V1
710 GOTO 540
720 GOSUB 1110
730 FOR O=1 TO SP:NEXTO
740 POKE U1+A1,32
750 IF S2=-1 THEN A1=A1-1
760 IF S3=-1 THEN A1=A1+1
770 IF A1<1 THEN A1=1
780 IF A1>21 THEN A1=21
790 LF=PEEK(U2+A1):IF LF=32 GOTO 820
800 IF LF=33 GOTO 820
810 GOSUB 1160
820 POKE U2+A1,33
830 POKE U2+A1,33
840 RETURN
850 PRINT"{SHFT CLR}{2 CRSR DNs}{CTRL 7}"
860 PRINTTAB(6)"{CTRL 9}TUNNEL RUN{2 CRSR DNs}"
870 PRINTTAB(2)"HOW FAST THROUGH{CRSR DN}"
880 PRINTTAB(2)"THE TUNNEL?{CRSR DN}"
890 PRINTTAB(2)"{CTRL 9}{CTRL 3}1{CTRL 0}{CTRL 7} (FAST
    ) TO {CTRL 9}{CTRL 3}9{CTRL 0}{CTRL 7}(SLOW)"
900 GET A$:IF A$=""GOTO 900
910 SP=VAL(A$)
920 IF SP<1 GOTO900
930 SP=SP*2
940 PRINTTAB(1)"{SHFT CLR}{2 CRSR DNs}HOW WIDE WOULD{CR
    SR DN}"
950 PRINTTAB(1)"YOU LIKE TUNNEL?{CRSR DN}"
960 PRINT"{CTRL 9}{CTRL 3}1{CTRL 0}{CTRL 7} (NARROW) TO
     {CTRL 9}{CTRL 3}9{CTRL 0}{CTRL 7} (WIDE)"
970 GET A$:IF A$=""GOTO 970
980 W=VAL(A$)
990 IF W<1 OR W>9 GOTO 970
1000 PRINT"{SHFT CLR}{2 CRSR DNs} HOW MANY CRASHES"
1010 PRINT"{CRSR DN} BEFORE  YOUR"
1020 PRINT"{CRSR DN} GAME{2 CRSR DNs}"
1030 INPUT MC$:MC=VAL(MC$):IF MC<1 OR MC>50 GOTO 1010
1040 PRINT"{SHFT CLR}{2 CRSR DNs} ALIENS IN TUNNEL?{CRS
    R DN}"
1050 PRINT"{CTRL 9}{CTRL 3}1{CTRL 0}{CTRL 7} (MANY) TO
    {CTRL 9}{CTRL 3}20{CTRL 0}{CTRL 7} (FEW){2 CRSR DN
    s}"
1060 INPUT ALIENS$
1070 ALIEN=VAL(ALIEN$)
1080 IF ALIEN<1 OR ALIEN>20GOTO 1040
1090 ALIEN=ALIEN+1
1100 PRINT"{SHFT CLR}":RETURN
1110 POKE DD,127
1120 S3=((PEEK(PB)AND128)=0)
1130 POKE DD,255
1140 P=PEEK(PA):S2=((PAND16)=0)
1150 RETURN
1160 POKE VOICE,0
```

More

Listing 1 continued.

```
1170 POKE 38422+A1+X1,2
1180 POKE U2+A1+X1,33
1190 POKE 36878,15
1200 POKE 36877,255
1210 FOR F=1 TO 100
1220 POKE 36879,104
1230 POKE 36879,14
1240 NEXT F
1250 CR=CR+1
1260 POKE 36877,0
1270 POKE 36878,8
1280 IF CR=MC THEN GOTO 1330
1290 POKE VOICE,V1
1300 POKE 36878,V
1310 POKE 38422+A1+X1,1
1320 RETURN
1330 FT$=TI$
1340 PRINT"{SHFT CLR}{2 CRSR DNs}{3 SPACEs}GAME OVER.{C
     RSR DN}"
1350 PRINT" YOU HAVE CRASHED{CRSR DN}"
1360 PRINT CR;" TIMES.{CRSR DN}"
1370 PRINT"{CRSR DN} Y{2 CRSR DNs}"
1380 FT$=MID$(FT$,3,2)+":"+MID$(FT$,5)
1390 PRINT TAB(5)FT$
1400 PRINT"{2 CRSR DNs} TRY AGAIN?"
1410 GET A$:IF A$=""GOTO 1410
1420 IF A$="Y"THEN RUN
```

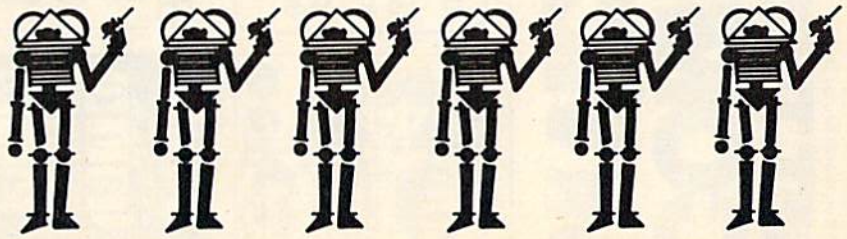
Listing 2. Tunnel Run program for the C-64.

```
10 REM **************
20 REM *            *
30 REM * TUNNEL RUN *
40 REM *            *
50 REM **************
60 PRINT"{SHFT CLR}"
70 POKE 52,48:POKE 56,48:CLR
80 POKE 56334,PEEK(56334)AND254
90 POKE1,PEEK(1)AND251
100 FOR I=0 TO 511
110 POKE I+12288,PEEK(I+53248)
120 NEXT I:POKE1,PEEK(1)OR4
130 POKE 56334,PEEK(56334)OR1
140 POKE 53272,(PEEK(53272)AND240)+12
150 FOR N=12288 TO 12288+7
160 READ H
170 POKE N,H
180 NEXT N
190 FOR N=12552 TO 12552+7
200 READ H
210 POKE N,H
220 NEXT N
230 FOR N=12784 TO 12784+7
240 READ H
250 POKE N,H
260 NEXT N
270 POKE 53281,1
280 VOLUME=54296
290 VCE=54273
300 CSCREEN=55296
310 CHAR=1024
320 DF=CSCREEN-CHAR
330 DIM S$(40)
340 FOR N=1 TO 40
350 S$(N)=""
360 FOR N2=1 TO N
370 S$(N)=S$(N)+">"
380 NEXT N2
390 NEXT N
400 PRINT"{SHFT CLR}"
410 GOSUB 860
420 POKE 53281,6
430 V1=255:V=10
440 A1=3:FG=1:U1=1024
450 U2=1064:U3=2023
460 T=1:A=4
470 TI$="000000"
480 DATA 226,164,27,40,108,176,175,132
490 DATA 195,195,68,60,24,24,60,24
500 DATA 255,129,189,165,165,189,129,255
510 T=8:A1=10
520 FOR N=1 TO 40
530 PRINT S$(4);SPC(14);S$(3);:PRINT""
540 NEXT N
550 GOTO 620
560 D=INT(RND(1)*2)+1
570 J=INT(RND(1)*AL)+1
580 IF J<>2 THEN GOTO 640
590 FA=INT(RND(1)*3)+1:FA=FA*D
600 F4=T+INT(W/2)+FA
610 IF F4>T+W OR F4<T GOTO 640
620 IF F4=PR GOTO640
630 POKE U3-40+F4,0:POKEU3-40+DF+F4,1
640 PR=F4:IF D=2 THEN D=-1
650 IF T+W+D>38 GOTO 680
660 IF T+D<1 GOTO 680
```

More

Listing 2 continued.

```
670 T=T+D
680 GOSUB 730
690 PRINT S$(T);SPC(W);S$(39-W-T);
700 PRINT""
710 GOSUB 1420
720 GOTO 560
730 GOSUB 1150
740 FOR O=1 TO SP:NEXTO
750 POKE U1+A1,32
760 IF S2=-1 THEN A1=A1+1
770 IF S3=1 THEN A1=A1-1
780 IF A1<1 THEN A1=1
790 IF A1>39 THEN A1=39
800 LF=PEEK(U2+A1):IF LF=32 GOTO 830
810 IF LF=33 GOTO 830
820 GOSUB 1210
830 POKE U2+A1,33
840 POKE U2+A1+DF,1
850 RETURN
860 PRINT"{SHFT CLR}{2 CRSR DNs}{CTRL 7}"
870 PRINTTAB(12)"{CTRL 9}TUNNEL RUN{2 CRSR DNs}"
880 PRINTTAB(8)"HOW FAST THROUGH{CRSR DN}"
890 PRINTTAB(8)"THE TUNNEL?{CRSR DN}"
900 PRINTTAB(8)"{CTRL 3}1{CTRL 0}{CTRL 7} (FAST) TO {CT
    RL 3}9{CTRL 0}{CTRL 7} (SLOW)"
910 GET A$:IF A$=""GOTO 910
920 SP=VAL(A$)
930 IF SP<1 GOTO910
940 SP=SP*2
950 PRINT"{SHFT CLR}{2 CRSR DNs}"TAB(8)"HOW WIDE WOULD{
    CRSR DN}"
960 PRINTTAB(8)"YOU LIKE TUNNEL?{CRSR DN}"
970 PRINTTAB(8) "{CTRL 3}1{CTRL 0}{CTRL 7} (NARROW) TO
    {CTRL 3}9{CTRL 0}{CTRL 7} (WIDE)"
980 GET A$:IF A$=""GOTO 980
990 W=VAL(A$)
1000 IF W<1 OR W>9 GOTO 980
1010 PRINT"{SHFT CLR}{2 CRSR DNs}";TAB(8)"HOW MANY CRAS
    HES"
1020 PRINTTAB(8)"{CRSR DN}BEFORE  YOUR"
1030 PRINTTAB(8)"{CRSR DN}GAME{2 CRSR DNs}"
1040 PRINTTAB(8)"";
1050 INPUT MC$:MC=VAL(MC$):IF MC<1 OR MC>50 GOTO 1010
1060 PRINT"{SHFT CLR}{2 CRSR DNs}"TAB(8)"ALIENS IN TUNN
    EL?{CRSR DN}"
1070 PRINTTAB(8)"{CTRL 3}1{CTRL 0}{CTRL 7} (MANY) TO {C
    TRL 3}20{CTRL 0}{CTRL 7} (FEW){2 CRSR DNs}"
1080 PRINTTAB(8)"";
1090 INPUT ALIENS$
1100 ALIEN=VAL(ALIEN$)
1110 IF ALIEN<1 OR ALIEN>20GOTO 1060
1120 ALIEN=ALIEN+1
1130 PRINT"{CTRL 4}"
1140 RETURN
1150 JV=PEEK(56320)
1160 JV=15-(JVAND15)
1170 IF JV=4 THEN S3=1:S2=0:GOTO 1200
1180 IF JV=8 THEN S2=-1:S3=0:GOTO 1200
1190 S2=0:S3=0
1200 RETURN
1210 POKE CSCREEN+A1+X1,2
1220 POKE U2+A1+X1,33
1230 POKE VOLUME,15
1240 POKE VCE,40:POKE54276,23
1250 FOR F=1 TO 100
1260 NEXT F
1270 POKE VOLUME,0
1280 CR=CR+1
1290 IF CR=MC THEN GOTO 1320
1300 POKE CSCREEN+A1+X1,1
1310 RETURN
1320 FT$=TI$
1330 PRINT"{SHFT CLR}{2 CRSR DNs}"TAB(12)"GAME OVER.{CR
    SR DN}"
1340 PRINTTAB(8)"YOU HAVE CRASHED{CRSR DN}"
1350 PRINTTAB(8)CR;" TIMES.{CRSR DN}"
1360 PRINTTAB(8)"{CRSR DN} Y{2 CRSR DNs}"
1370 FT$=MID$(FT$,3,2)+":"+MID$(FT$,5)
1380 PRINT TAB(12)FT$
1390 PRINTTAB(12)"{2 CRSR DNs} TRY AGAIN?"
1400 GET A$:IF A$=""GOTO 1400
1410 IF A$="Y"THEN RUN
1420 POKE VOLUME,15
1430 POKE VCE,32
1440 POKE VCE,0
1450 POKE VOLUME,0
1460 RETURN
```



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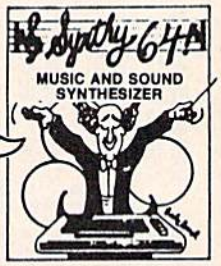

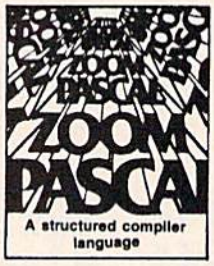

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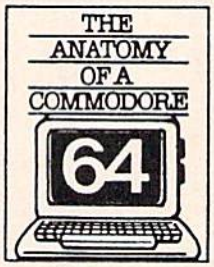

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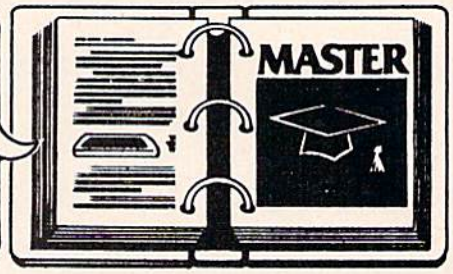

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It's Up to You

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Keep up the excellent work and quality—your readers will appreciate it and it will be your readers who will make *RUN* a tremendous success

Frank Johnson
Bethpage, NY

Ahs and Ohs

Congratulations on your premiere issue. The layout and print size are perfect. The program listings are very clear and easy to read, a great improvement over copies from dot matrix printers used in some other publications.

One improvement you could make is use a 0 for zero. This would lessen any confusion for beginners like myself.

Christopher R. Blakeley
Fort Pierce, FL

That you're pleased with RUN *greatly pleases us. You'll notice that the zeroes have been slashed for this issue; future issues will contain slim zeroes and full Os, so you'll be able to distinguish between the two.*

Editors

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Got a gripe, comment, compliment or question? We'd like to hear from you. Send your letters to *RUN* magazine, MailRUN, 80 Pine St., Peterborough, NH 03458.

Lookin' Good

Your premiere issue looks very good. The article on C-64 word processing software is especially helpful and thorough. Your straightforward appeal of "like"/"didn't like" is just what readers like me want and need. I've already talked up your publication with three C-64 friends/owners.

Harold Germer
Wayne, PA

Thanks for your straightforward comments. We hope you always have a new reason to talk us up 'cause that's the direction in which we're headed.

Editors

No Cheating

While playing Sea Battle, which appeared in your premiere issue, I found that it's pretty easy to cheat on the computer by shifting to lowercase and viewing where the computer's ships are located. A line that could be added to disable the Commodore/shift keys is this: 5 PRINT CHR$ (8).

I found your first issue very enjoyable and informative. I especially like the step-by-step description of the programs.

Donald Cortes

Sold

In one word—excellent!

I just happened to buy *RUN* from the store because of the feature, "Close Encounters with C-64 Word Processing," on p. 58. By p. 12, you had a new subscriber.

RUN is the type of magazine I've been looking for but couldn't find—a well written, professional magazine for the serious computer user.

Thomas Killeen
Milford, MA

The MAGIC of It

I really enjoy your MAGIC column. I think that the idea of exchanging secrets among computerists is great.

Donald Johnson
Prior Lake, MN

We do, too. After all, everyone knows that secrets are best when they're shared.

Editors

Building for Next Month

I am more of a builder than a programmer, and would like to see articles on projects designed for the C-64 and so on. Such add-on devices like modems and memory expansion boards are very expensive; it's much less costly to build them.

I enjoy *RUN*, but I'd like to see articles on the construction of such items.

Edward B. Whittaker
Arcadia, FL

Take heart, all you do-it-yourself types. We plan to expand our coverage of the Commodore systems with hardware modifications and construction articles, including a regular monthly column on interfacing your system to the outside world.

So get that solder gun warmed up and ready for action.

Editors

In Search of a Tenth Planet

By Charles T. Kowal

©California Institute of Technology 1959

This professional astronomer feels at home in the heavens using his Commodore 64. Read how this noted star-gazer eschews the larger mainframe computers for the C-64 in his search to discover the tenth planet.

For as long as I can remember, I've been interested in astronomy. During my childhood, I built my own telescopes and read every astronomy book I could find. I never doubted that I would become a professional astronomer.

One of the enjoyable things about working in this field is the nature of the equipment I get to use—large telescopes and sophisticated electronic instruments. And now I have a new joy—microcomputers.

When I was a college student some 20 years ago, undergraduate science majors rarely studied computer programming. We calculated using desktop calculators with hand cranks or electric motors, and everybody carried a slide rule.

Ten years ago, I was using an IBM computer, painstakingly typing my programs onto punched cards. I never imagined that for a few hundred dollars I'd soon be able to buy a powerful computer system, including a printer and mass storage device, that would fit comfortably on top of my desk!

Astronomic Calculations

Astronomy has always been intimately tied to mathematics. Since the time of the ancient Greeks, long, tedious calculations have been a part of every astronomer's work. Until the middle of the 20th Century, astronomers often hired people to do the more routine calculations. These people were called "computers!"

Electronic computers gradually came into use starting in the late 1940s. By the 1970s, almost every astronomer had to be a computer programmer. The Fortran language was invented in 1957 and is still the most popular language for scientific programming.

Most computing used to be done on large mainframe computers, but now mini-computers like the PDP-11 and VAX-11 are increasingly popular. These machines are usually found in time-sharing systems, where 40 or more people can use the computer at the same time.

Centralized computing facilities have many problems, however. It is sometimes necessary to wait for an unoccupied terminal, operating system changes are beyond the user's control, and these big computers are definitely not user-friendly. But now we have an alternative—personal computers.

Microprocessors have been in use for controlling instruments since before 1970. In these applications, the microprocessor is not used as a computer in the usual sense of the word, but is dedicated to a specific task. Only in the last five years have true microcomputers come into use for the multitude of number-crunching jobs that every astronomer must face.

There are certainly many problems in astronomy that require a large computer. Nevertheless, much can be done with a micro. I think it is fair to say that many astronomers do not realize how powerful these little machines really are. They still tend to think of microprocessors and microcomputers as control devices for operating telescopes and instruments.

But even very inexpensive microcomputers can handle surprisingly complex calculations. I have a Commodore 64, and I now use it for all my computing tasks, writing all my programs in Basic or assembly language.

Micro-Advantages

My specialty is the solar system, and I sometimes need to compute the orbits of asteroids, comets and planets. My C-64 can do this job in a few minutes, with plenty of memory to spare.

It's true that a mainframe computer can do the same thing in a few tenths of a second, but I don't mind waiting a few minutes. After all, I don't have to wait for a terminal to be free. My computer is always there on my desk, ready to go. Nor do I have to wait for the "public" printer to get around to printing my job. My Okidata printer is also right there on my desk, and it prints at the respectable speed of 120 characters per second.

It is sobering to remember that all of the "classical" work in orbit determination was done in the 19th Century with pencil, paper, and a table of logarithms. The patience of earlier generations of astronomers was truly awesome!

Is a big mainframe computer, using Fortran, really faster than a desk-top micro using interpreted Basic? Not always! Certainly the big computer will run a program hundreds of times faster than the small machine. But before you can run a program you have to write it!

Have you ever tried to debug a Fortran program? It's an interminable sequence of Load, Edit, Link, Compile, Run—over and over again. Does one line of your program contain a plus sign where it should have had a minus sign? Sorry! Load the program again, change the plus to a minus, link the program, compile it, run it again. Find another error? Sorry! Load the program again...

There's no point in saving a few minutes of run-time if it takes you several extra days to write the program. With the C-64, the editing functions are built-in, so it's just a matter of listing the offending line, moving the cursor to the error and making the change. Inserting and deleting lines is just as simple. You can even buy a compiler to compile a Basic program after it's thoroughly debugged.

Celestial Positions

Let's look at a few specific examples of astronomical problems in relation to the relative merits of small and large computers.

Because the Earth's axis wobbles a little, the positions of all the stars gradually change. This is called "precession." By definition, the Earth's axis points to the North and South Celestial Poles. As the axis wobbles, the positions of the poles change, and so do the

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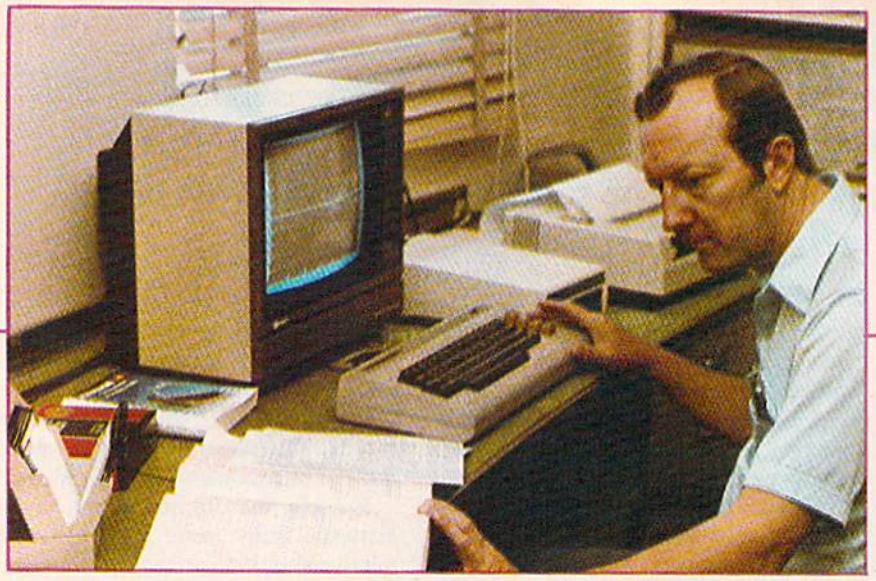

Charles Kowal at work.

His rare enthusiasm for observing the heavens has led him to 20 years of celestial discovery, including the second brightest supernova of the century. Highly respected for his work, Kowal spends as much time as possible at Mount Palomar Observatory. He is now engaged in the search—referred to in this article— for a suspected tenth planet.

coordinates of every object in the sky. This all happens in a smooth, predictable way.

Because of precession, as well as smaller wiggles called "aberration" and "nutation," every time an astronomer wants to point his telescope at an object, he must compute its current position. Hence, the computation of precessed positions is one of the most common mathematical problems faced by every astronomer.

It is a fairly simple problem, however. My Commodore can compute a position, and print it out, in about one second. In problems like this, the C-64 is a clear winner over the big computers, since it can complete the whole job in less time than it takes to walk to the nearest terminal or line printer.

The big computers do have the advantage in large tasks when a whole catalog of 250,000 star positions is available on magnetic tape or disk. The computer can then access any desired star very quickly, or can even plot a chart of all of the stars in a certain part of the sky. Even here, however, the C-64 is capable of similar things if it's connected to ten megabytes of hard disk memory.

Many tasks require the inputting of large amounts of data from the keyboard. In cases like this, the big computers have no advantage at all. You can type just about as fast on a C-64 as on an IBM terminal. The simple, but powerful, screen-editing capabilities of the Commodore are also a big help.

In moderately complex computations, like the determination of the orbit of an asteroid or comet, the micro and mainframe computers are about evenly matched. My Commodore can compute a simple orbit in about one minute. It takes several times longer if I add enhancements like statistical fits to many observations. The big computers can do this sort of thing in a fraction of a second, but we must also include the time it takes to get to a terminal and to retrieve the printed output.

The mainframe computers are clearly superior for much more complex problems such as the determination of the "definitive" orbit of an asteroid. A definitive orbit includes the gravitational effects of all the planets. Hundreds of observations of the object may be combined statistically. This is a very complicated calculation, which a big computer can complete in a few minutes.

Just for the fun of it, I once wrote a program to do this on my C-64. The program took 16 hours to run! Even this was not prohibitive, however, since I merely started the program running at 5 p.m., and the printed output was ready for me when I returned to my office the next morning.

Perhaps I've been a little too hard on the mainframe computers. They can, after all, do things my C-64 cannot, such as handling vast amounts of data. Problems like debugging and editing on the large computers *can* be solved with elaborate debugging and editing programs.

That's why the big computers come with bookshelves full of documentation (written in computerese), while Commodore's documentation consists of only a few hundred pages (written in English). But, for my needs, the convenience and accessibility of the Commodore outweigh the mainframe's advantage of greater power.

Neptune's Mystery Motion

A few months before I bought my Commodore, I started an investigation of the orbit of the planet Neptune. Astronomers know there is something "wrong" about the motion of Neptune, for they haven't been able to compute an orbit that will fit all the measurements of that planet's positions.

One possibility is that Neptune is being disturbed by an unknown outer planet. A careful study of the motion of Neptune might lead to a prediction of the unknown planet's location.

I became frustrated with the limitations of our office time-sharing computer. I wanted something that I could use more conveniently, and even take with me on trips to Palomar Observatory.

I chose the Commodore 64, because it has enough memory to be truly useful, there are no extras (like expansion interfaces) to buy, the disk drive has a built-in controller, and the disks hold 170 kilobytes, which most manufacturers would call "double density." All this also makes the price of the system almost irresistible.

After I bought the C-64, it was a simple matter to translate my old Fortran programs into Basic. I found that the Commodore could handle all my jobs easily, even computing a position of Neptune in about a minute.

The easy editing and general convenience of the C-64 make it simple to write programs and modify them as needed. I use the high-resolution graphics capability to display results in an easily-understandable format.

For example, I developed a graph to show the difference between the observed positions of Neptune and the positions predicted from Neptune's computed orbit. A screen dump of this graph gave a clear visual picture of the evidence that the orbit is wrong.

Something unknown is affecting the motion of Neptune. My Commodore 64 and I will try to find out what it is! R

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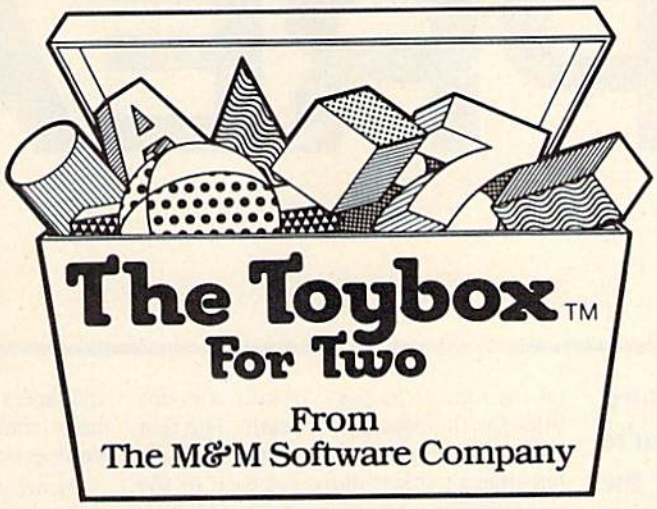

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By Joseph J. Shaughnessy

SPREAD

You may not be acquainted with the term, but you're bound to be familiar with the concept. A spreadsheet is a valuable tool that clearly and concisely displays information (in a rows-and-columns format). And the best part is that it's not just for business use; it is easily understood by the average person.

Many new computer owners are curious about electronic spreadsheets, and almost as many have never heard of them and don't know what they're for. First, they are not attachments to your electric blanket or transistorized butter knives.

A spreadsheet is an accounting and managerial tool for using and presenting a lot of information in an orderly, easily understood manner. However, this doesn't mean that only accountants and managers find them useful.

Spreadsheets have been around, in one form or another, as long as there have been written records. Most people have used them for years without knowing it. If you've ever filled out a catalog order form, prepared or examined an invoice or bill, or read your child's report card, you have used a variety of spreadsheet.

Spreadsheet Structure

The basic spreadsheet consists of an array or table composed of rows and columns of information. The first row (at the top of the page) usually contains titles for the columns beneath. The first column (left side of the page) usually has titles or descriptions for each of the rows. Rows read left to right; columns read top to bottom.

The last column (on the right) and the last row (on the bottom) usually contain totals or summations of the information in the other columns and rows. The use of spreadsheets gave rise to the popular expression, "What's the bottom line?"

One of the best things about a spreadsheet is that all the information is right there in front of you; you can see all the facts that went into any answer or total. Thus, you can often spot errors, bad assumptions or poor planning at a glance.

Until the arrival of the personal or home computer, spreadsheets were done by hand, with pencil and paper. The problem with that was that any changes to values within the rows and columns were not only time-consuming, but usually affected other values throughout the spreadsheet. This required either a lot of erasing or the preparation of several spreadsheets with variations of the same information, leading to different "bottom lines."

This type of multiple spreadsheet preparation to give different answers for your consideration is known as "what-if" analysis. You are trying to determine, before taking action, what happens if you do this, or, alternatively, that.

In the past, the number of what-ifs was limited by the amount of time you could spend rewriting and recomputing different versions of the same spreadsheet. Despite the time involved, many managers still used this procedure to help make decisions about possible courses of action.

Now, with the advent of the personal computer, an electronic spreadsheet serves not only as your paper and pencil, but also as your eraser and calculator. The computer can erase, rewrite and recalculate values and entire spreadsheets in just a few seconds. The computer does not replace the human mind, but merely does the "donkey work." The mind still directs the actions to be taken.

Rows, columns and cells (cells are the individual "holding boxes" located at the intersections of the rows and columns) are usually interrelated with other rows, columns and cells through mathematical operations. For instance, the values in the cells of one column could be the result of adding (or multiplying, dividing, etc.) the cells in several other columns.

Cells can contain values (numbers that are directly input), labels (text or words that do not enter into any calculations) or formulas. Formulas are special. A formula is a mathematical expression such as A1 + B1, which means to add the value found in the cell at row A, column 1, to the value found in the cell at row B, column 1, and place the result in the cell containing the formula. The formula will also remain in the cell, and any later changes made to the values in A1 or B1 will be reflected in a new value for the cell holding the formula.

Formulas can be highly complex. They can include cell coordinates, numbers or constants, and in many spreadsheets can include entire or partial rows and columns to be acted on by the

SHEETS

So, What's the Bottom Line?

mathematical operations. For example, if you wanted a cell to hold the value of the total of row B from column 1 to column 12, your formula for that cell might read SUM(B1:B12).

One drawback to electronic spreadsheets is that you generally can't see the whole spreadsheet all at once on your video display. You can, of course, see the whole thing if you print it out on your printer. If you have more text than can be output in 80 columns, you can print the spreadsheet in sections and tape them together.

On the video display, you look through a "window" at the spreadsheet. The window only lets you see a portion of the spreadsheet at one time, but you can see the entire thing by moving your window around.

The size of your window is determined by the size of your video display (C-64: 40 characters wide by 25 rows high; VIC-20: 22 characters wide by 23 rows high). This is when you really appreciate an 80-column screen. You soon get used to using your window, however, and all spreadsheets have commands for moving your window rapidly around.

In order to give greater meaning to the comparison chart that follows this article, you should understand a little more about the special features and qualities that are available. A discussion of the items compared appears in the accompanying table. (The discussion considers only the C-64 and VIC-20 computers.)

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Explanation of Spreadsheet Terminology

Language: This is the language in which the program is written. Machine Language (M.L.) and Compiled Basic will operate faster than Basic. However, a Basic program with M.L. subroutines can be almost as fast. Speed of operation is not that critical except on the larger spreadsheets.

Cell Size: This is the column width (in number of characters) that can be displayed on the video screen or the printout.

Matrix Size: This is the number of rows and columns that you can have on your spreadsheet. Some of the programs can vary the number of both columns and rows, up to a maximum value for each.

The *combined total* of rows plus columns is limited by the number of cells permitted. Other programs give you a preset number of rows and columns, but you can use fewer than the maximum permitted if you wish.

Media Available: Tape, disk or cartridge. A security key, which plugs into a joystick port, is sometimes required. The security key is for software piracy protection.

Disk Commands: All programs permit you to save your spreadsheet and load it in again later. Some programs also include a version of the C-64 Wedge that enables you to use many disk commands. Tape commands are Load, Save and, in one case, Verify.

Arithmetic Operators: These are the normal operators, such as addition, subtraction, division, multiplication, exponentiation (square, cube, etc.), that you can use in your formulas. "( )" indicates if you are allowed to use parentheses in your formulas. Parentheses can be essential in complex formulas. For average home use, they are less important.

Mathematical Functions: These higher order accounting functions include such things as sum of a column or row of figures, figure percentage, percentage added or subtracted, percentage difference, find the average, or find maximum or minimum value in a column or row. Higher order scientific functions include greater than, less than, equals, square root, absolute value, integer value, logs (natural or base-10), trig functions, Boolean operators, If-Then-Else and others.

Screen Shift or Paging: This is a convenience that lets you shift to the next adjacent screen in any direction in one move, rather than repeatedly hitting your cursor control.

Go To or Jump To Another Cell: All the spreadsheets reviewed have this necessary feature, which allows you to move your window and cursor to any other location on the spreadsheet in one jump, rather than hitting your cursor controls many times.

Menu or Help Page or Prompts: A Menu or Help page will tell you your options at the touch of a key. Menu or Help prompts will give you a list of what you can do next, based upon your last entry. Both devices are designed not to leave you stranded in the middle of an operation without knowing what to do next.

Automatic Cursor Advance: This feature will save you a keystroke when entering data. Ordinarily, you'll enter a value, text or formula, hit the return key and then use the cursor key to go to the next cell. With this feature, you can skip hitting the return key and just hit the cursor key. Your entry will be placed in the current cell, and you will automatically advance to the next cell, in whichever direction of travel you have selected. Very handy!

Table continues.

BCALC

This electronic spreadsheet is a versatile program for both the Commodore 64 and VIC-20. BCALC automatically compensates for the differing screen sizes for both computers and adjusts itself for any extra memory in the VIC-20 beyond the required 16K expansion. It will let you see two columns at a time on the VIC-20 and four columns on the C-64.

BCALC is designed primarily as an accounting type of spreadsheet (rather than full scientific), and gives you some useful accounting-type mathematical functions. The program is written in compiled Basic, so it runs pretty fast.

BCALC uses all of the function keys and is very easy to operate.

What I Liked...

Values over 9,999,999 are designated with an "M" to represent million (for example, 14.5M for fourteen and a half million). Fairly comprehensive accounting functions are also a welcome feature.

BCALC can be used with both the C-64 and VIC-20. This lets me transport files between both of my computers.

Printer output will automatically go to a second or third page if the information will not fit on one page. I found this to be particularly convenient.

Titles for the rows and columns are always displayed on the screen. BCALC also features a special title block to give a name to the whole spreadsheet.

What I Didn't Like...

In order to prevent writing over data that is already in a cell, you must hit the f5 key before each entry into a cell. Most other spreadsheets don't require this, and I was constantly forgetting to hit the key. If this is the only spreadsheet you use, it shouldn't be a problem.

Probably because of the restrictions imposed by making the program compatible with both the C-64 and the VIC-20, you are limited to seven characters (including the + or − sign and the decimal) in any cell. You are also limited to having text or labels only in the special title row and column.

BCALC will perform calculations on a row, column or cell, but (and this is a big BUT) the program will not remember individual cell calculations on any recalculations (only row and column formulas are remembered). Therefore, any special calculations that you have done for just one cell will be lost unless you put that cell in a row or column by itself.

Summary...

This program, despite some of the drawbacks mentioned above, is fairly good for a beginning user. It is very simple to use—almost idiot-proof—and you have to know very little about computers, printers or even spreadsheets in order to use it.

BUSICALC 64

This electronic spreadsheet for the Commodore 64 is also an accounting type rather than a full scientific spreadsheet. Written in Basic, BUSICALC 64 operates a little slower than some others. (I understand that there is a new version, called BUSICALC II, on the market, written in machine language, but I didn't have a copy for this review.)

BUSICALC 64 doesn't make use of the function keys available on the C-64, but does use special keystrokes called forth from a function menu to accomplish the same thing.

I've used this program for some time, and have always been satisfied with its performance.

What I Liked...

Editing formulas and values is very easy, and formatting of printer output is top notch—you can even put commas in the numbers. A printout will automatically go to a second or third sheet if required without a wrap-around. Also, automatic cursor advance makes data input easy, and upper/lowercase letters are available in the printout.

What I Didn't Like...

BUSICALC is slow. You must sometimes wait for the computer to come back from its "garbage collection" routine in order to proceed with whatever you're doing. [Ed. note: This problem has been eliminated in a new version, BUSICALC II, now available.]

Summary...

All in all, this is a worthwhile spreadsheet. As I've said, I've used it quite a bit and always found it a dependable workhorse of a program.

EASY CALC RESULT

A cartridge-loaded spreadsheet for the Commodore 64, EASY CALC RESULT falls under the classification of a full scientific spreadsheet, with many

advanced features and functions.

Without having seen either program, I had assumed that EASY CALC RESULT was a stripped-down version of the more expensive and extensive CALC RESULT, by the same manufacturer. If that is so, CALC RESULT must be amazing, for EASY CALC RESULT is remarkably full-featured.

What I Liked...

I don't usually like cartridges, but in this case it is so convenient not to have to wait for the program to load. EASY CALC RESULT is very fast. You can fix the titles in the left column, and the color of each individual cell can be selected, or you can global-format a character color.

You can enter cell coordinates into a formula by placing the cursor over the cell coordinate that you want and then hitting the return key. The cell format code—either global or individual—is displayed in a little window whenever you put the cursor over a cell.

Also impressive is the screen display of the colored bar graphs, and you can dump any screen to the printer at any time by hitting the f6 key. When you're in text mode, a cell can contain up to 255 characters. These can be printed out, and printer formatting is good in allowing you to choose different column widths.

Also included are exotic math functions (such as net present value, standard deviation and Boolean operators), the If-Then-Else statement and contin-

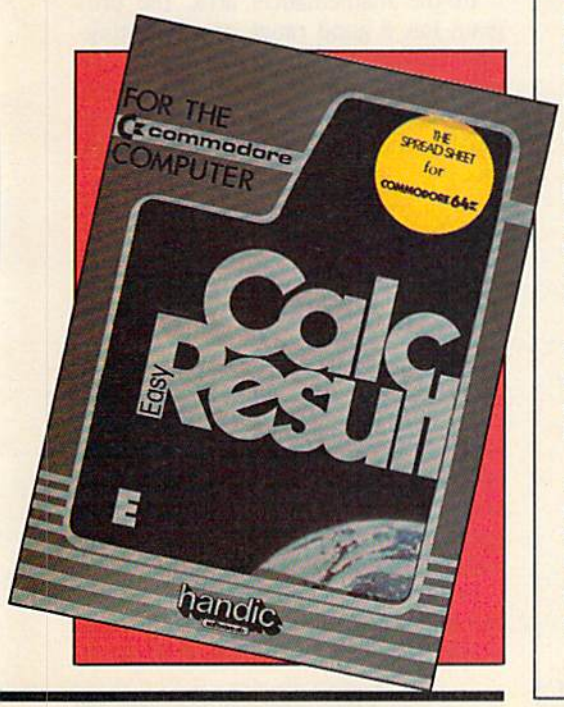

Table continued.

Change Screen Colors: A nice feature to have, especially if you are using a color TV and have found that some color combinations work best when reading text. The programs that don't have this feature have preselected screen colors that work well with both color TVs and video monitors.

Cell Formatting—Individual and Global: Formatting allows you to select how the values and text that you enter will appear on the screen display and the printout. Individual formatting lets you select the format of a single cell. Global formatting lets you select the format for the cells of the entire spreadsheet. Normally, global cell formatting will not override individual cell formatting, which allows you to change the global format without worrying that you are destroying any special cases you established for some cells.

In the programs that allow you to enter text as well as values into cells (some only permit text in column and row titles), text is normally left-justified, and values are right-justified. Left-justified means that the text in the display starts at the left boundary of the column; right-justified means the text finishes against the right boundary. Formatting for left- and right-justification allows you to change this normal pattern either for an individual cell or for the whole sheet. Other useful formatting commands are as follows:

Integer—All numbers after the decimal point are dropped, and the value is displayed as a whole number.

$—Values are displayed in dollars and cents format (two decimal places).

Scientific—Values are displayed in scientific notation. E.g., 12E+04 means 12 × 10 to the 4th power (which really means 120,000). This is useful when dealing with large numbers that would not ordinarily fit into the number of characters available in the cell. Some spreadsheets default to scientific notation when the number becomes too large to be displayed in normal form.

Maximum Precision—This is the ordinary floating point format of the computer. The number is displayed showing as many decimal places as are required or possible. This is the usual initial format for most of these spreadsheets.

Decimal—You can select the number of decimal places you want on the display. Integer and $ formats can be displayed with this formatting instruction, as well as any other number of decimal places (within cell limits, of course).

Cell Color—Only Easy Calc Result has this feature, which is especially attractive when used with the graphic display to get multi-colored hi-resolution bar charts.

Graphic Bar Charts—Some of the programs allow the values in cells to be displayed as bar charts, either with asterisks or in hi-resolution graphics.

Hi-res Graphics—Will convert bar charts using asterisks to hi-resolution bar charts.

Column Widths—This is often set from the global formatting option.

Edit Formulas or Cells: In order to change the contents of a cell, you must either retype the information into the cell or edit what is in a cell without retyping. This is a convenience, not a necessity.

Insert or Delete Rows and Columns: Sometimes, when working on a spreadsheet, it occurs to you that it would be better to have an extra row or column inserted between those you've already completed. Or else, for your final presentation copy, you might decide to "close-up" the spreadsheet by deleting rows and columns. Since most people make an occasional mistake, this feature is almost a necessity.

Automatic Re-Reference of Formulas After the Insert/Delete Function: Most formulas have to be adjusted after the Insert or Delete function has been used, since the shifting-around process has changed the values in many cell coordinates. If you had to do this yourself, you would end up chewing on the rug. Luckily, the computer will do this for you.

Clear or Blank Cell: Sometimes you want to have an "empty" cell.

Clear Sheet: This will let you scrap the whole spreadsheet and start over on a new "sheet of paper."

Replication: This function lets you copy values, text and formulas from cell to cell. You'd use it, for instance, if a column had the same basic formula for all the cells in the column, such as "add columns B and D together and place the sum in E." The formula for column E, row 1, would be "B1+D1," for row 2, "B2+D2," and so on for all the rows in column E (we'll use row 20 as the final row for this example).

The simple way to enter all of these formulas is to use replication. You'd enter the formula in cell E1 and replicate the formula to cells E2 thru E20. Now, the second part of replication is to select relative or absolute replication. If you select absolute replication, cells E1 through E20 would *all* contain the formula "B1+D1." This absolute replication is useful for some things, such as filling a column with a constant or a text such as $/Lb., but in our case, you need something else.

You'd choose relative replication (for both B1 and D1 in the formula), and now your column E would have the formulas "B2+D2" in row 2, "B3+D3" in row 3, all the way to "B20+D20" in row 20. You also could have chosen relative replication for B1 in the formula and absolute for D1 to give the results "B2+D1"...."B20+D1." Replication is a real timesaver. The three types are discussed next.

Replicate Cell to Cell: This is the simplest type, and consists of copying one cell to another location. The contents of the "source" cell remain intact.

Table continues.

uous prompt menus. I could go on, but you get the picture.

What I Didn't Like...

You can't use the Save and Replace a File feature with the disk drive. If you want to save an update of a spreadsheet, you must give it a new name.

There are some problems with the instruction manual. The first example uses a wider column width format than the preset startup width, and you aren't told how to change the width until later in the manual. An index would also be helpful, especially with so many different functions available for use.

Another shortcoming is that the printout doesn't make allowance for an 80-column printer, and lines will wrap around if you aren't careful to print out blocks of data small enough to fit the 80-column printer. It is also annoying that you can fit only nine spreadsheet files on each disk; the program saves the *entire* spreadsheet, even though you have used only a small portion of it.

Summary

This is an outstanding program that makes me wish I had CALC RESULT to try.

ESP-CALC

Designed for both the C-64 and the VIC-20, ESP-CALC differs from the others I'm reviewing in its prompts and manner of presentation. By responding to a series of questions, you establish the size of the spreadsheet, load in a previous model or start anew, give titles to all the columns and rows and then set up your formulas. All this happens before you get to see the blank spreadsheet.

The question and answer format continues when you proceed to save your sheet or clear a sheet. The procedure is different, but not unpleasant; you can see that the authors have tried to make the program user friendly.

Screen display is limited to eight characters, but ten characters can be held in a cell for printout. Screen row and column titles are fixed, text is only permitted in the titles, and each row and column title must be unique within that row or column. There's no direct replication function, but it is possible to replicate by adding zero to values in a row or column and placing the answer where you want the values replicated.

What I Liked...

ESP-CALC works well with both the C-64 and VIC-20, permitting shared files between these computers. You can set delimiter lines (either underlining or vertical lines) on your visual display and printout, and the visual display wraps around to the beginning when you reach the end of your spreadsheet.

A nice feature is that when you print out formulas, you get both a shorthand version, using cell coordinates, and a longhand version, using the row and column titles. The printout function also makes allowances for printer width, and will go the more-than-one-page route if necessary.

In the mathematical area, the program has a good range of accounting-type functions, and the test-calculations mode allows you to step through your formulas one at a time to find errors. Finally, the instruction manual is very nice.

What I Didn't Like...

Sound effects that go on and on during setup and calculations eventually become annoying; it would be helpful to have a keystroke to shut them off. More serious is that there is apparently no error-checking on the disk saves. I foolishly left a write-protect tab on my disk and thereby lost a spreadsheet I was trying to save. Commercial programs like this are supposed to let you make dumb mistakes without penalty.

Another problem is that you can delete and insert rows and columns only during the load operation of a previ-

Table continued.

Replicate Cell to Range: This will copy the value, text or formula in one cell to a "range" of other cells. The copying can be relative or absolute. The range of cells can be either all or a portion of a row or column, or even, in some programs, a block of rows and columns.

Replicate Range to Range: In this function, you can copy (either relative or absolute) a row, column or block to another row, column or block of equal size. This is a one-for-one copy. If you have ten cells in your source range, you must also have ten cells in your destination range. Also, the number of rows and columns in the source and destination ranges must be the same. This can get tricky in the relative mode. The values or formulas of the cells in the source range remain unchanged.

Move Cells, Rows, Columns and Matrices (Blocks): This works just like replication, except the contents of the source cells are emptied after the move. It is a true move, not a copy function.

Fix Titles in Place on the Screen: This convenient function will fix the first row and column in place on the screen. As you jump around your spreadsheet, the titles of the rows and columns will remain on the top line and left margin for easy orientation as to where you are on the spreadsheet.

Change Column Width: You will often find you want to make your columns wider or narrower than the startup preset (usually 8–10 characters wide). You'd do this to improve the screen display or printout, either to see more columns at one time or to see more precise numbers in your columns. Most, but not all, of the spreadsheets allow you to input bigger numbers or more text than is displayed on the spreadsheet video output.

If you increase the column size, the full text would then be displayed. The size of your column is limited by the cell size. Also, this is an all-or-nothing proposition. All columns will change to the new size. One exception is that some of the programs will allow you to specify one column as being larger or smaller than the others (such as a Title column). Usually, the column size you have selected will govern your printout, but some programs allow special printer formatting that may differ from your selected column size. This will be discussed later.

Calculate Individual Cell: Sometimes, when you're entering data, you'd like to see the result of the calculations on your current cell as you enter the cell values of a formula, but without recalculating the entire spreadsheet.

Manual/Automatic Calculation of the Entire Spreadsheet: On a large spreadsheet, the time required to calculate the entire sheet can become annoying if it happens after every entry. In Automatic mode, the spreadsheet is recalculated after every entry. By going to Manual mode, you delay calculation of the entire spreadsheet until you actually give a command to calculate. Sometimes you may prefer to recalculate the spreadsheet after every entry, especially if you're making changes to an existing spreadsheet. With both the Manual and Automatic modes, you have a choice.

Change Order of Recalculation: Most spreadsheets will first calculate down one column, then down the next, and so on. You may prefer to have the program perform calculations row by row instead of column by column. This option allows you to do this.

Escape Key: What do you do if you are in the middle of an entry or operation and you don't want to continue (mistake, change your mind, don't know what to do next, etc.)? Why, you just push

Table continues on page 54.

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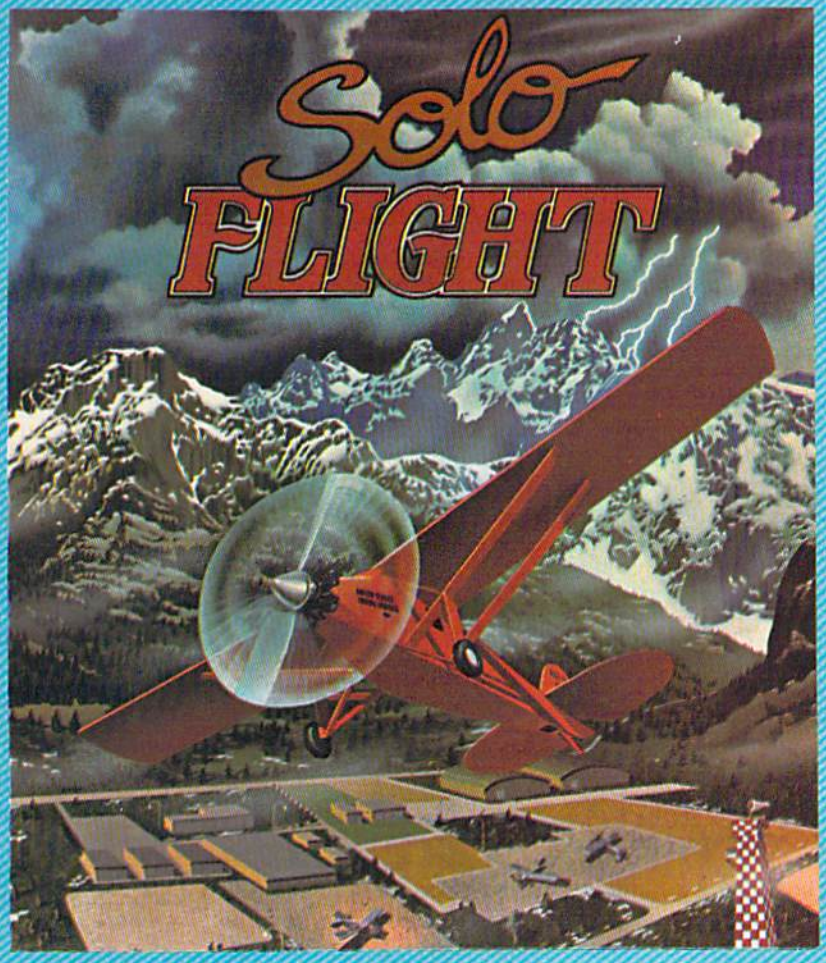

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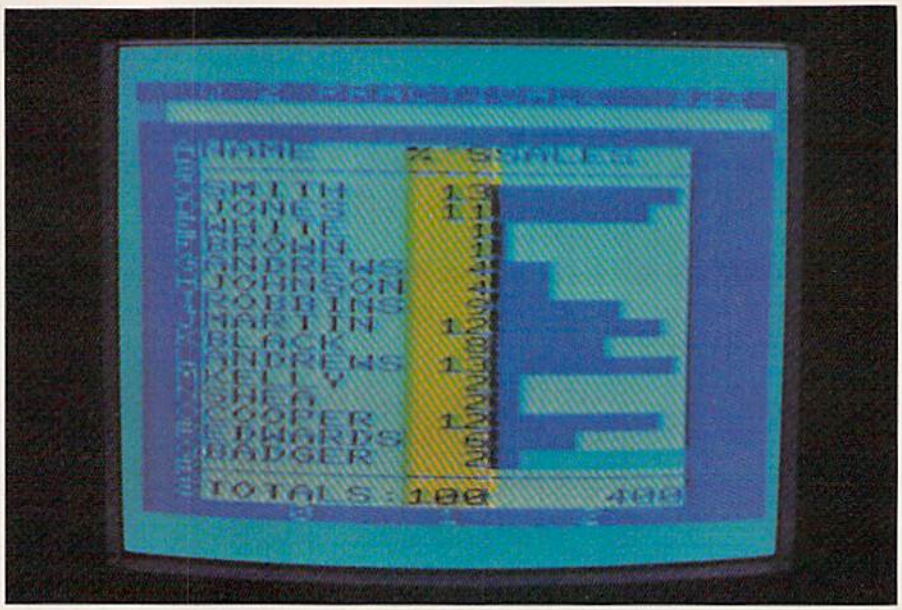
ously saved spreadsheet. Also awkward is that you input formulas on a special screen, which means you can't see the spreadsheet while you are entering the formula. Lastly, ESP-CALC is written in Basic, making it slower than some of the other programs.

Summary...

Despite some of its faults, I found this program interesting. It can be useful for both home and business because of its extensive accounting functions. I also think it would be fairly easy for beginners to use.



HOME-CALC

HOME-CALC is an electronic spreadsheet for the Commodore 64. Written entirely in machine language, it is both fast and simple to use. While lacking some of the more exotic mathematical functions, it does provide for bar graphs on the screen and printout.

I was told that simplicity of use was one of the chief design goals, and it is certainly one of the simplest programs to use. Almost all operations can be done with a single keystroke (actually two, since the CTRL key is used in conjunction with other keys for some operations). The small, but complete, help screen is called by the f7 key; it actually overlays the bottom part of the spreadsheet screen—a nice touch.

What I Liked...

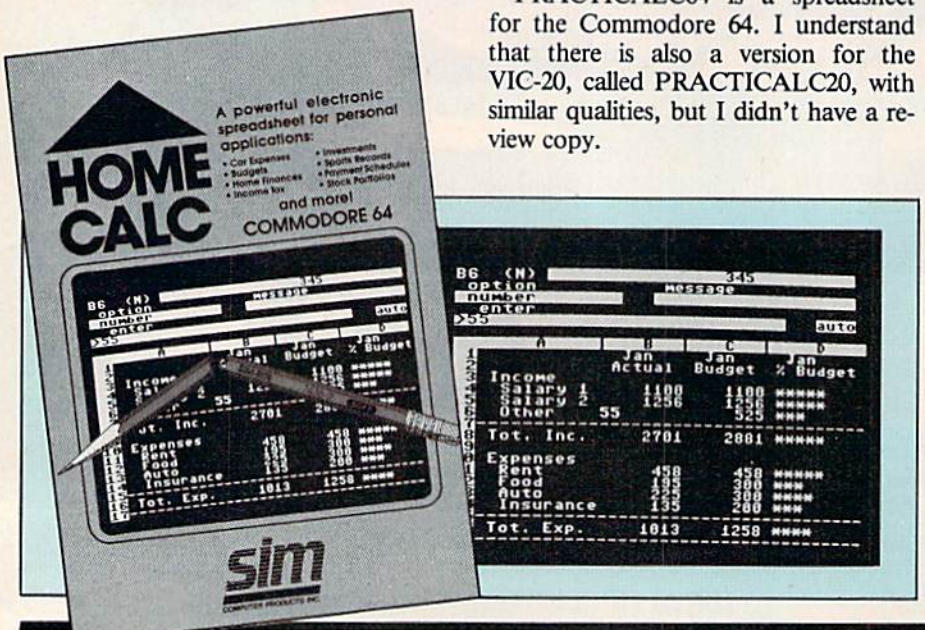
The program is simple to use, has a nice screen format and a paging feature, and can make full use of the disk Wedge commands.

What I Didn't Like...

There are a few minor and easy-to-spot errors in the instruction manual. Also, the printout does not make allowances for printer width—you have to do it yourself.

Summary...

I would recommend HOME-CALC as a simple program for home uses that do not require the advanced math functions.



PRACTICALC64

PRACTICALC64 is a spreadsheet for the Commodore 64. I understand that there is also a version for the VIC-20, called PRACTICALC20, with similar qualities, but I didn't have a review copy.

PRACTICALC64 would be classified as a full scientific spreadsheet, with many advanced mathematical functions and options for low- and high-resolution graphic bar charts. It can search for a specific entry, even using a "wild card" similar to that used with disk drive loads. It can also sort the rows alphabetically or numerically and even sort the bar graphs.

The setup for the program is in Basic, but the machine language subroutines appear to be longer than the Basic portion. In any event, it seems to run at machine language speed.

It has a special mode of operation, called Direction Function, which enables one person to create the spreadsheet and another to use or update it without needing explanation. The person doing the updating is prompted for each input required in the update. Very impressive!

What I Liked...

PRACTICALC64 has very fast cursor movement (almost too fast at times) and superfast insertion and deletion of rows and columns. The Direction Function mentioned above is excellent, and I also especially liked the Search and Sort functions, the lo-res and hi-res bar charts and the wide range of math functions.

What I Didn't Like...

It was confusing that column numbers were at the bottom of the screen instead of the top; no big deal, but I just wasn't used to it. There are a few slight errors in the instruction manual but these are easy to spot.

A more serious drawback is that the printout is limited to 80 columns, so you have to print out the larger spreadsheets in zones (sorry, I like it when the computer figures it out for you). It would also be nice to be able to format the printout, which you cannot do in the present version.

Summary...

This is an outstanding program that could be used both at home and in the office.

SPREADSHEET ASSISTANT

An electronic spreadsheet for the Commodore 64, SPREADSHEET ASSISTANT is part of Rainbow's popular Assistant Series. Output from this program can be utilized by the companion word processor program, WRITER'S ASSISTANT, and integrated with the new graphics package, GRAPHICS ASSISTANT.

This would probably be classified as an accounting type of spreadsheet. The program appears to be either compiled Basic or machine language. In any event, it runs fast. The operation was perfect in every way, with one exception. I couldn't get it to behave properly with my 1525 printer.

You can use Rainbow's spreadsheet program with their word processing and graphics packages.

Rainbow has built exhaustive printer commands and instructions for handling non-Commodore printers and interfaces into this program. The instruction manual led me to believe I could get my columns of numbers to be aligned on the printed sheet.

It is a well-known fact that users of non-Commodore printers become, of necessity, printer experts. They learn all about special control codes and secondary addresses that we poor Commodore printer owners don't usually get into. I tried everything I could think of, but couldn't get it right.

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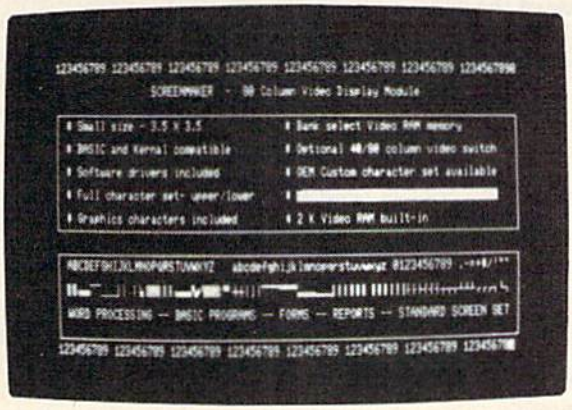

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clude all these fancy printer controls in its program (which I think is great), it should include an appendix for the Commodore printer owners, explaining the beauties of the system. Lord knows, the Commodore printers manual doesn't tell you anything about it.

But don't let my experience with the printer keep you away from this otherwise excellent program. I'd recommend that Commodore printer owners give it a try in the store, on the Commodore printer, before bringing it home.

What I Liked...

Features I especially liked are the ability to change screen colors; a comprehensive Help Page, a good screen display with constant display of the cell formatting and of memory remaining.

Also admirable are the use of the disk Wedge commands and the ability to integrate with a word processor and graphics package.

What I Didn't Like...

Outside of my printer difficulties, I found that the program doesn't make allowances for having only 80 columns on your printer (like so many of the other programs reviewed).

Summary...

This is a very good program, but limited to the simpler accounting functions. It would be suitable for most home and office uses.

* * *

Some of you will undoubtedly be using these electronic spreadsheet reviews as an aid in making a purchase of this remarkable tool. That's what reviews are for, but you should bear in mind that some software manufacturers are aiming their product strictly at the home market, while others are trying to satisfy both the home and business markets.

This makes some of the comparisons seem a bit unfair. In making your software selection, you should first determine what your needs are. Where will you be using this program (home or office)? Who will be using it (would they know what to do with trig functions, let alone Boolean operators)? What are *you* going to use it for (if it's going to do lab reports in college, it had better do more than add and subtract)?

Finally, the last question, which should be the first: Why do you want a spreadsheet? Only you can answer, but I hope this article has helped. R

On the following two pages, we present a comparison chart listing the features of the VIC-20/C-64 spreadsheet programs reviewed in this article. The chart was compiled from information provided by the manufacturers, taken from the documentation supplied with the packages or based on the author's review of the spreadsheet programs.

Table continued from page 50.

your friendly escape key and get out of that situation. Escape keys should enable you to get out of any situation, but sometimes they don't work in the middle of a disk or printer operation. They are still nice to have.

Home Key: This keystroke allows you to move your cursor from anywhere on the spreadsheet back "home" to the cell at row 1, column 1. Sometimes you have to press it twice. The first keystroke puts your cursor in the upper left corner of your window, and the second keystroke moves you home.

Search and Sort Function: Only PRACTICALC64 had this feature, but it is so nice that I had to include it in the categories. This function allows you either to search for a certain text or value and put your cursor on it, or to sort rows alphabetically (backwards or forwards) or numerically (highest to lowest value or vice versa). The rows are actually rearranged and formulas are re-referenced. Very nice!

Print Formulas: With this option, you can dump to your printer all the formulas used in your spreadsheet. The cell coordinates containing the formula are printed, and then the formula. It is a lot easier than moving your cursor from cell to cell on the screen and reading the formulas that way.

Format Printer Output: In your final printout, you may wish to exclude certain columns from the presentation, or to vary column widths to make the printout more readable. You may also wish to have your numbers appear in the form 1,000,000, instead of 1000000. Also, some of the spreadsheet programs have a preset mode that allows you to ask for a bigger block of information than your printer can handle in 80 columns. The columns that run off the edge of the paper are saved and printed on a second page after the first page is finished.

Some of the programs don't do this, and if your block of information is too large, the printer wraps the line around and makes the spreadsheet difficult to read. With these programs, you have to be careful to ask for your printout in chunks small enough for your printer to handle. For this category on the comparison chart, printer formatting refers only to the ability to select the width of each separate column on your printout.

Upper/Lowercase for Printout: This is a nice feature but not essential.

Graphic Bar Charts: This allows you to display values as strings of asterisks or as high-resolution bar charts instead of numbers. You may have to adjust the numbers in the cell to get it within the range of the display (for instance, divide the number 730 by 100 to get a display of seven asterisks). The size of the display is limited by the cell size (e.g., if your cell size is 19, you can only have 19 asterisks).

PRACTICALC64 has a hi-res mode that replaces the asterisks with a true bar and increases the allowable range by a factor of eight. EASY CALC RESULT does not have the asterisks, only a hi-res mode, and you can set the range to anything you want. The program will make the adjustments to the numbers for the display. EASY CALC RESULT also allows differently colored bars in the chart. Nice!

Quality of Instruction Manual: This is obviously a value judgement on my part. I tried to be "dumb" about spreadsheets as I approached each new program, and to let the manual lead me, but I doubt that I entirely succeeded. All the manuals were adequate in teaching me to use the program they were introducing. I usually began to play with a program without reading the manual first (as many other users will do), in order to see how idiot-proof the manufacturers had made the program. I found a few bugs this way.

Price: As in most things, you get what you pay for. You'll generally find that price and performance go together in software, but not always. I did this article "blind" in that I did not receive or seek any pricing information until I was finished. I feel that this helps to eliminate one prejudice during evaluation.

Price, of course, will be a concern to readers considering the purchase of an electronic spreadsheet. Evaluate what your needs are, compare them with the features offered in the various programs, plug in your price considerations, multiply by a frustration factor and then pick your program.

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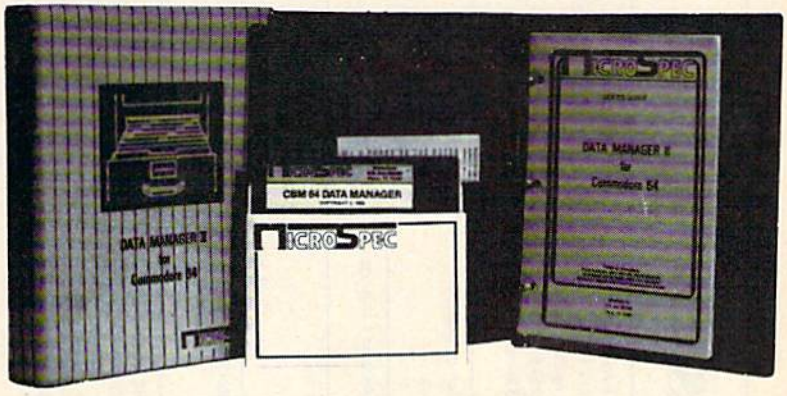

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Computers	Same program VIC-20 w/16K Commodore 64	Commodore 64	Commodore 64	Same program VIC-20 w/24K Commodore 64	Commodore 64	Commodore 64	Commodore 64
Language	Compiled Basic	Basic	Machine Language	Basic	Machine Language	Basic with Machine Language	Machine Language or Compiled Basic
Cell Size	7 Display Labels/Title 4/Row 5/Cols.	5-18	5-18	7 Display Labels/Title 5/Row 8/Cols.	3-37	3-38	1-20
Matrix Size Row × Col.	35 × 99—C-64 26 × 40—VIC-20/16K 35 × 50—VIC-20/24K	Varies up to 99 × 99 1100 Cell Max.	63 × 254 1023 Cell Max.	Varies with # of formulas 3000 Cell Max.	26 × 99	Varies up to 100 × 250 2000 Cell Max.	52 × 200
Disk Commands	Load & Save	Load & Save	Load & Save	Load & Save	All Commodore Disk Commands	Load, Save & Verify	All Commodore Disk Commands
Arithmetic Operators	+ − / *	+ − / * ↑	+ − / * ↑ ( )	+ − / * ↑	+ − / * ↑	+ − / * ↑ ( )	+ − / * ↑ ( )
Mathematic Functions	%, %change, Sum, Avg., Max., Min.	Sum, Avg., Max., Min.	Basic Functions Boolean Operators IF-THEN-ELSE	%, %+, %−, %change, Sum, Avg., Max., Min.	Sum	> < =, Sum, Avg., Log & Trig. Functions & many more	Sum
Screen Shift or Paging	No	No	No	No	Yes	No	Yes
GOTO or Jump to Another Cell	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Menu or Help Page or Prompts	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Available Memory Indicator	N/A	Displayed by Pushing Key	Yes	Displayed at Startup	Displayed by Pushing Key	Displayed by Pushing Key	Yes
Automatic Cursor Advance	No	Yes	Yes	Yes	No	Yes	Yes
Change Screen Colors	No	No	No, but can change color of each cell	No	No	No	Yes
Format Individual Cells*	No	L, R, D	I, $, L, R, C, G, M	D	S, D, G	I, $, G, L, M	I, $, L, R, M
Global Formatting*	M, $	Limited Selection at Startup	Same as Cell Formats Plus Column widths	No, Preset	S, D, G Default = $	I, $, M Hi-res Graph Column Width	$, L, R
Edit Formulas or Cells	No, must retype	Yes	Yes	Yes	No, must retype	No, must retype	Yes

Insert and Delete Rows and Columns	No	Yes	Yes	Yes	Yes	Yes	Yes
Automatic Reference after Insert/Delete	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Clear or Blank Cell	By entering a zero value	Yes	Yes	Yes	Yes	Yes	Yes
Clear Sheet	Yes	No, but can copy empty cells on full	Yes	Yes	Yes	Yes	Yes
Replicate Cell to Cell	No	Yes	Yes	No	Yes	Yes	Yes
Replicate Cell to Range	No	Yes	Yes	No	Yes	Yes	Yes
Replicate Range to Range	No	Yes	Yes	No	No	No	Yes
Move Cells, Rows, Columns or Matrices	No	No	Yes	No	No	Move Columns and Rows	No
Fix Titles in Place on Screen	Yes	No	Yes	Yes	No	Yes	No
Change Column Width	No	Yes, but only at startup	Yes	No	Yes	Yes	Yes
Calculate Individual Cell	Yes	Yes	Yes	Yes	No	Yes	Yes
Manual/Auto Calculate Sheet	Yes	Yes	Yes	Manual only	Yes	Manual only	Yes
Change Order or Recalculation	Yes, in Manual Mode	No	Yes	Yes	No	No	Yes
Escape Key	Yes	Yes	Yes	No	Yes	Yes	Yes
Home Key	Yes	No	Yes	Yes	Yes	Yes	No
Search & Sort Functions	No	No	No	No	No	Yes	No
Print Formulas	No	No	No	Yes	Yes	Yes	Yes
Format Printer Output	No	Yes, including commas in the numbers	Yes	No	No	No	No
Upper/Lowercase for Printout	No	Yes	Yes	No	No	No	It should but wouldn't for my 1525
Graphic Bar Charts	No	No	Yes	No	Yes	Yes	No
Quality of Instruction Manual	Fair	Good	Very Good, but needs an index	Very Good	Good	Good	Good
Suggested List Price	$39.95 cassette $49.95 disk	$69.00	$79.95	$43.50 cassette $47.50 disk	$24.95 cassette $29.95 disk	$49.95 cassette $54.95 disk	$69.95

*Formatting Key

$ = Two Decimal, S = Scientific, M = Max. Precision, R = Right Justify, C = Cell Color, D = Set Decimal,
G = Graphic Bar Charts, I = Integer, L = Left Justify

Serpent of Death

Venomous cobras, mummified zombies and even King Tut himself are all here in this Egyptian setting that will keep you hopping from pyramid to pyramid.

By Jim Hoppe

RUN It Right

VIC-20 with 3K expansion

Address author correspondence to Jim C. Hoppe, S. 5309 Glenrose Road, Spokane, WA 99203.

Serpent of Death is an action arcade-style game requiring timing and skill to move "King Tut" down an ancient Egyptian pyramid while avoiding the killer cobra.

Each block on the pyramid changes color and scores one point as King Tut jumps from square to square. Stomp the killer cobra and score an extra 100 points; but watch out! If the cobra bites King Tut, he has only seconds to live.

The cobra venom is inactivated by touching the mummy who appears alongside the pyramid. If you press the fire button, the mummy will carry King Tut back to the top of the pyramid.

The difficulty increases as higher levels are reached. You can advance from level one to level two either by stomping the cobra or by filling in all the squares on the pyramid. Difficulty is increased at succeeding levels by requiring a greater number of cobra stomps to advance to the next level; by alternating between as many as four mummies who flash from spot to spot next to the pyramid; and by requiring all squares to be colored—as well as cobras stomped—to advance in the highest levels.

Game Design

Designing the Serpent of Death in Basic was challenging, yet fun! The initial problem in game design is coming up with a workable idea that is within the capabilities of both the machine and the programmer. This is critical and requires a certain amount of creativity. Many workable ideas for the beginner can be derived from already successful games.

After setting up wooden blocks on a table, I began to sketch a rough pyramid shape on paper. I broke down the basic units of the drawing in an attempt to use the VIC graphics designs already on the keyboard. It soon became evident that I'd need custom characters. Fig. 1 shows the basic building blocks of the pyramid.

Since the pyramid remains static except for color changes, I decided printing would be the easiest method for producing the design. Lines 120 through 160 accomplish this task in the program.

Using a flow chart makes life much easier in the long run. A good basic design makes it simple to modify and expand upon an idea without completely rewriting the program. My completed flow chart looked like that in Fig. 2.

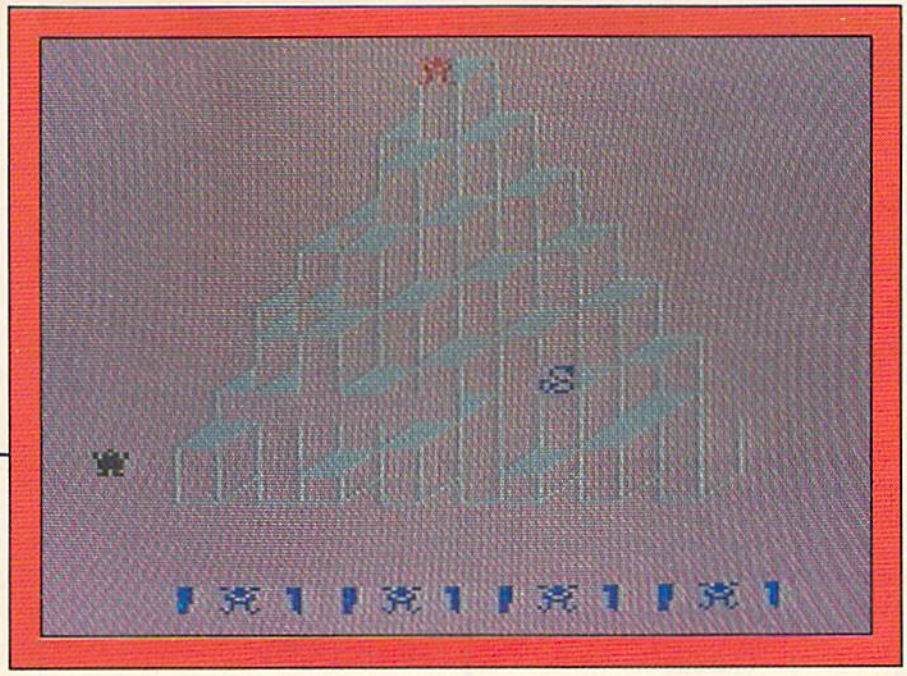
Of course, a flow chart can be more detailed, but I prefer to keep mine general and fill in the details of each subroutine in Basic. If the subroutine is highly complex, a flow chart may then be required. This was the case of the jump-and-fall-to-the-square subroutine (see Fig. 3), which took me some time to perfect.

Program Details

The expression I developed for movement of characters on the screen is

```
POKE S+H+22*V, CN
POKE S+H+22*V, CC
```

where S, the starting position of Tut at the top of the pyramid, equals 7713. V = vertical position, CC = character color, H = horizontal position and



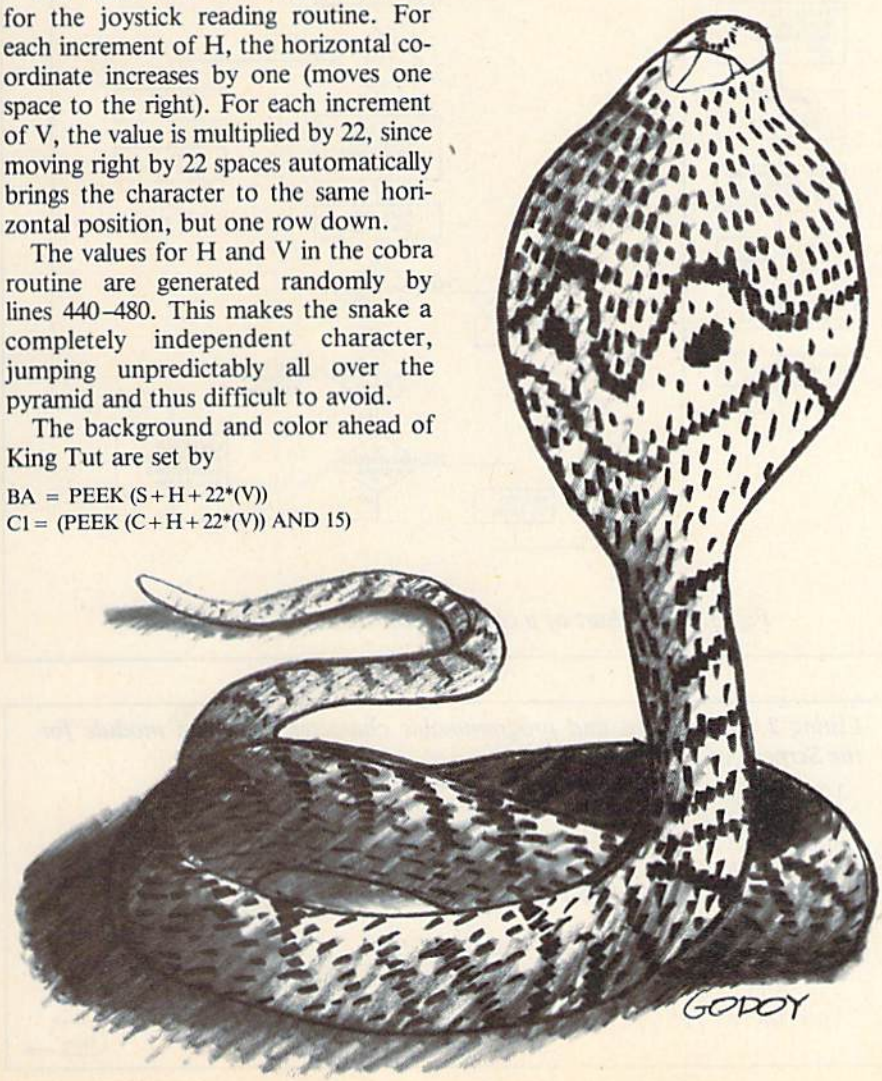
CN = character Poke value. Separate variables for the cobra and King Tut make their movements independent.

The values of H and V are obtained for the joystick reading routine. For each increment of H, the horizontal coordinate increases by one (moves one space to the right). For each increment of V, the value is multiplied by 22, since moving right by 22 spaces automatically brings the character to the same horizontal position, but one row down.

The values for H and V in the cobra routine are generated randomly by lines 440–480. This makes the snake a completely independent character, jumping unpredictably all over the pyramid and thus difficult to avoid.

The background and color ahead of King Tut are set by

```
BA = PEEK (S+H+22*(V))
C1 = (PEEK (C+H+22*(V)) AND 15)
```



where C, the starting position of color at the top of the pyramid, equals 38432. S = 7713 (starting position of Tut), H = horizontal position and V = vertical position.

The order of events is to look at the character color and shape, memorize these values by placing them in variables, place the figure and then erase the figure with previous background and color. This sounds simple, but its proper functioning requires considerable care in design.

When Peeking color, the value must be a logical AND with 15 to filter out any values other than the basic colors 0 through 15. An originally simple concept soon becomes complex as more and more details are worked out.

As the limits of the game are reached, bugs creep in, as usual, that require program modification and change in variable values. As an example, the background color for the snake must be changed to white when a level change is made. Otherwise, the previous background color will be Poked on the top square.

I thought all the bugs were worked out of the program, only to have one of my children, a more capable games player than I, push the routines to the limit and discover a situation I had not yet provided for.

I hope you have fun and a minimum of frustration in loading and running this game. If you wish to send me $3, a SASE and a blank cassette or diskette, I'll be glad to copy and return the program to you. R

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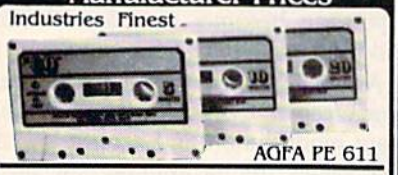

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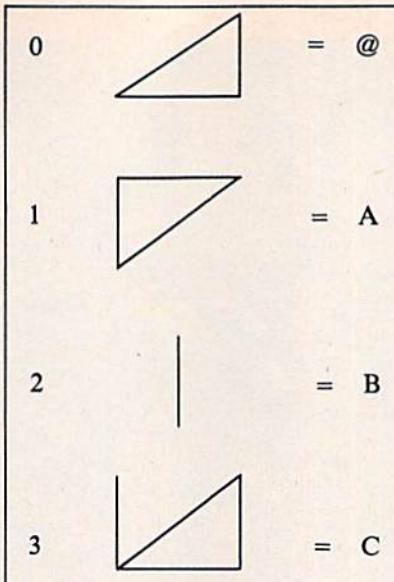

Fig. 1. The basic building blocks of the pyramid.

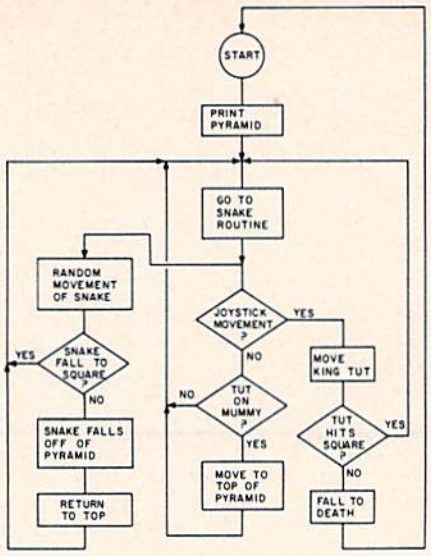

Fig. 2. Flow chart for the Serpent of Death program.

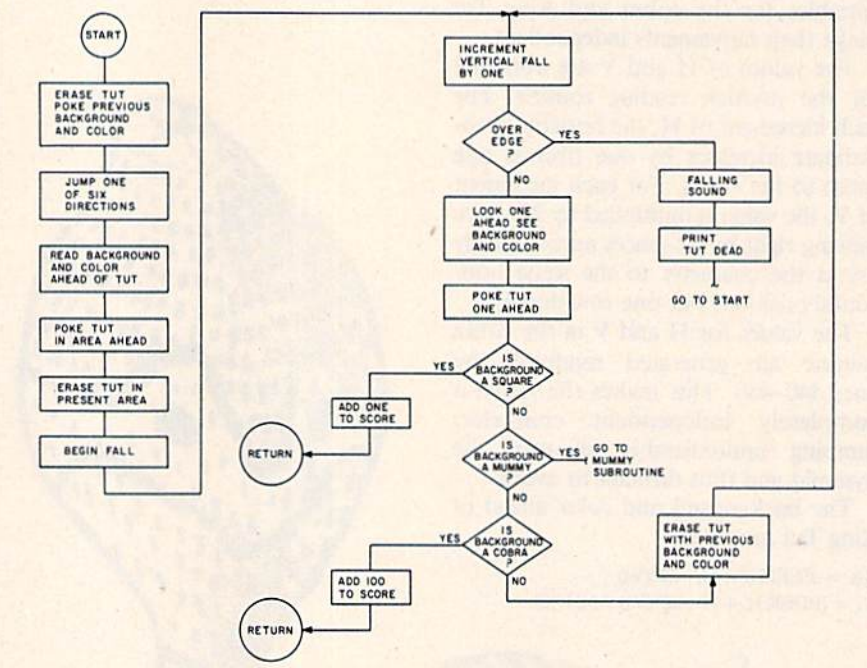

Fig. 3. Flow chart of a complex subroutine in the program.

Listing 1. Instructions and programmable character definition module for the Serpent of Death program.

```
10 REM INSTRUCTIONS
20 POKE36878,15
30 POKE51,0:POKE52,28:POKE55,0:POKE56,28:CLR:CB=7168
40 READA:IFA=-1THEN70
50 FORN=0TO7:READB:POKECB+A*8+N,B:NEXT
60 GOTO40
70 POKE36869,255
80 IFGS=2THENHS=HS+1
90 DATA0,1,3,7,15,31,63,127,255
100 DATA1,255,254,252,248,240,224,192,128
```

More

Listing 1 continued.

```
110 DATA2,128,128,128,128,128,128,128,128
120 DATA3,129,131,135,143,159,191,255,255
130 DATA4,90,60,90,102,60,36,36,195
140 DATA5,219,60,90,102,60,36,165,66
150 DATA6,16,170,186,124,124,124,40,108
160 DATA7,60,60,126,213,126,60,0,0
170 DATA8,30,38,34,16,204,178,162,92
180 DATA9,126,60,219,231,255,66,24,24
190 DATA32,0,0,0,0,0,0,0,0
200 DATA10,128,128,128,128,128,128,128,255
210 DATA11,129,130,132,136,144,160,192,128
220 DATA12,0,0,0,6,15,63,127,231
230 DATA13,0,0,0,0,128,192,224,240
240 DATA14,0,0,0,0,0,0,0,0
250 DATA15,231,255,79,31,31,31,15,7
260 DATA16,224,240,240,240,240,240,240,224
270 DATA17,0,0,62,127,227,193,192,192
280 DATA18,7,7,3,3,3,3,3,1
290 DATA19,224,224,224,224,224,192,192,192
300 DATA20,224,224,224,112,56,56,56,56
310 DATA21,1,1,1,1,0,0,0,0
320 DATA22,192,192,225,247,255,127,63,24
330 DATA23,248,240,240,224,192,128,0,0
340 DATA24,0,64,64,64,160,0,0,0
350 DATA25,0,0,0,0,0,0,0,24
360 DATA26,24,0,0,0,0,0,0,0
370 DATA27,1,2,28,4,4,0,0,0
380 DATA28,1,2,4,8,16,224,32,32,-1
390 GOTO460
400 POKE7680+X,12:POKE7681+X,13:POKE7682+X,14:POKE7702+
    X,15:POKE7703+X,16:POKE7704+X,17
410 POKE7724+X,18:POKE7725+X,19:POKE7726+X,20
420 POKE7746+X,21:POKE7747+X,22:POKE7748+X,23
430 POKE38400+X,5:POKE38401+X,5:POKE38402+X,5:POKE38422
    +X,5:POKE38423+X,5:POKE38424+X,5
440 POKE38444+X,5:POKE38445+X,5:POKE38446+X,5:POKE38466
    +X,5:POKE38467+X,5:POKE38468+X,5
450 RETURN
460 PRINT"{SHFT CLR}":POKE36879,25
470 X=24:GOSUB400
480 X=39:GOSUB400
490 PRINT"{2 CRSR DNs}{9 CRSR RTs}{CTRL 9}{CTRL 1}{CTRL
    3}THE{CTRL 0}"
500 PRINT"{2 CRSR DNs}{3 CRSR RTs}{CTRL 9}SERPENT OF DE
    ATH{CTRL 0}"
510 X=24:GOSUB400
520 X=39:GOSUB400
530 FORB=0TO22:POKEB+7680,8:POKE38400+B,5:NEXTB
540 FORB=0TO22:POKE7702+B*22,8:POKE38422+B*22,5:NEXTB
550 FORB=0TO22:POKE7723+B*22,8:POKE38443+B*22,5:NEXTB
560 FORB=0TO20:POKE8165+B,8:POKE38885+B,5:NEXTB
570 PRINT"{CTRL 9}{2 CRSR DNs}{6 CRSR RTs}{CTRL 1}STARR
    ING:{CRSR DN}"
580 PRINT"{CTRL 1}{CRSR DN}{5 CRSR RTs}{CTRL 9}KING TUT
    {SPACE}{CTRL 0}{CRSR RT}{2 SPACEs}{CTRL 3}D{SPACE}
    {CTRL 7}"
590 PRINT"{CTRL 1}{CRSR DN}{5 CRSR RTs}{CTRL 9}THE MUMM
    Y{3 SPACEs}{CTRL 7}{CTRL 0}F"
600 PRINT"{CTRL 1}{CRSR DN}{5 CRSR RTs}{CTRL 9}MS. COBR
    A{3 SPACEs}{CTRL 6}{CTRL 0}H"
610 PRINT"{2 CRSR RTs}{2 CRSR DNs}{CTRL 9}{SPACE}{CTRL
    5}INSTRUCTIONS Y/N?"
620 GETA$:POKE7725,27:POKE38445,2:POKE7740,27:POKE38460
    ,2
630 FORG=0TO15:POKE36878,15-G:POKE36877,253:NEXTG:T=INT
    (RND(1)*1500)+200:FORX=1TOT:NEXT
640 IFA$="Y"THEN700:IFA$="N"THENCLR:GOTO880
650 POKE7725,28:POKE38445,2:POKE7740,28:POKE38460,2
660 FORZ=1TO50{2 Zs}
670 IFA$=""THEN620
680 IFA$="Y"THENGOTO700
690 CLR:GOTO880
```

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Listing 1 continued.

```
700 POKE36869,242:PRINT"{SHFT CLR}{CTRL 4}{SHFT R}ULES{
    S{2 SHFT SPACEs}{SHFT G}AME"
710 PRINT"{SHFT J}UMP {CTRL 8}{SHFT K}ING {SHFT T}UT{CT
    RL 4} FROM ONEBLOCK OF THE"
720 PRINT"{CTRL 3}{SHFT T}HE{SHFT SPACE}{SHFT A}NCIENT{
    SHFT SPACE}{SHFT P}YRAMID{SHFT SPACE}OF{SHFT E}GYP
    T"
730 PRINT"{CTRL 4}TO THE NEXT.{CRSR DN}"
740 PRINT"{CTRL 4}{SHFT E}ACH STEP ON "
750 PRINT"{CTRL 3}{SHFT T}HE {SHFT A}NCIENT{SHFT SPACE}
    {SHFT P}YRAMID{SHFT SPACE}OF{SHFT E}GYPT"
760 PRINT"{CTRL 4}CHANGES COLOR AS A{4 SPACEs}POINT IS
    SCORED."
770 PRINT"{CRSR DN}{SHFT J}UMP ON THE {SHFT C}OBRA AND
    SCORE 100 POINTS BUT  WATCH OUT!!{CTRL 4}"
780 PRINT"{CTRL 3}{5 CRSR DNs}{4 CRSR RTs}HIT ANY KEY":
    POKE198,0
790 GETA$:IFA$=""THEN790
800 PRINT"{SHFT CLR}{CTRL 4}{SHFT I}F THE SNAKE LANDS O
    N {SHFT K}ING {SHFT T}UT HE IS BITTEN AND HAS  SEC
    ONDS   TO LIVE."
810 PRINT"{SHFT O}NLY THE {SHFT M}UMMY HAS THENEEDED PO
    WER TO SAVE  {SHFT K}ING {SHFT T}UT FROM {CTRL 1}{
    SHFT D}EATH{CTRL 4}."
820 PRINT"{CRSR DN}{SHFT A} FALL OFF OF THE{5 SPACEs}{S
    HFT P}YRAMID TAKES {SHFT K}ING {SHFT T}UTTO THE {C
    TRL 1}{SHFT T}OMB!{CTRL 4}
830 PRINT"{CRSR DN}{SHFT J}UMP INTO THE {SHFT M}UMMY'S
    WAITING ARMS AND HE{3 SPACEs}WILL CARRY YOU BACK T
    OTHE TOP";
840 PRINT" OF{13 SPACEs}{CTRL 3}{SHFT T}HE{SHFT SPACE}{
    SHFT A}NCIENT {SHFT P}YRAMIDS{8 SPACEs}OF {SHFT E}
    GYPT"
850 PRINT"{2 CRSR DNs}{2 CRSR RTs}{2 SPACEs}{CTRL 3}HIT
     ANY KEY"
860 GETA$:IFA$=""THEN860
870 PRINT"{SHFT CLR}":CLR:POKE36869,255:POKE36878,0:GOT
    O880
880 POKE36877,0:POKE36869,240:PRINT"{SHFT CLR}{4 CRSR D
    Ns}LOAD"CHR$(34)"SERPENT 8K"CHR$(34)",8{3 CRSR UPs}
```

Note: If you are using the Datassette recorder instead of a disk drive, you must omit *the ,8 at the end of line 880.*

Listing 2. The Serpent of Death program.

```
10 REM SERPENT OF DEATH BY JIM & TOM HOPPE APRIL '83
20 POKE36869,255:GOTO1120
30 DIMJS(2,2)
40 FS=7991:FC=38711:SS=7713:CS=38433:S=7712:C=38432
50 IF4*(PEEK(36866)AND128)+64*(PEEK(36869)AND112)=4096T
   HENGOSUB1110
60 FORI=0TO2:FORJ=0TO2:READJS(J,I):NEXTJ,I
70 TS=0:L=1:AA=100:DD=37154:PA=37137:PB=37152:CD=1
80 BS=1:VS=5:BS=1
90 POKE37139,0:POKE36878,15
100 IFPEEK(52)=28THEN110
110 POKE36879,157:POKE36869,255
120 PRINT"{SHFT CLR}{CTRL 2}"TAB(32)"@AB"TAB(32)"BBB"TA
    B(31)"@BCAB"TAB(31)"CABBB"TAB(30)"{SPACE}BBBCAB"
130 PRINTTAB(8)"@BCABBB"TAB(29)"@@ABBBCAB"TAB(29)"BBBBC
    ABBB"TAB(28)"@@BCABBBCAB"
140 PRINTTAB(6)"C@ABBBCABBB"TAB(27)"{SPACE}BBBBCABBBCAB
    "TAB(27)"@@BCABBBCABBB"
150 PRINTTAB(4)"{SPACE}BCABBBCABBBCAB"T{2 SPACEs}@ABBBC
    ABBBCABBB"
160 PRINTTAB(4)"BBBCABBBCABBBBB"TAB(25)" JKJJKJKJJKJKJK
    "
170 POKES+H+22*V,4:POKEC+H+22*V,2
180 GOSUB1080
190 IFTS>0THENTS=(TS-1)
200 GOSUB420
210 JS=JS(X+1,Y+1):IFJS<8THENGOSUB270
220 IFFR=1THENGOSUB700
230 IFTS=0ANDVN=1THENGOTO980
240 IFTS>0THENPRINT"{HOME}{CTRL 9}{20 CRSR DNs}COBRA VE
    NOM ACTIVE "RIGHT$(STR$(TS),2)
250 GOTO180
260 REM JUMP
270 POKES+H+22*V,BA:POKEC+H+22*V,C1
280 IFJS=0THENV=V-4:IFV<-3THENV=-1
290 IFJS=1THENV=V-3:H=H+1:IFV=-3THENV=-1
300 IFJS=2THENH=H+1:V=V-1
310 IFJS=3THENH=H+1
320 IFJS=4THENV=V+1
330 IFJS=5THENH=H-1
340 IFJS=6THENH=H-1:V=V-1
350 IFJS=7THENV=V-3:H=H-1:IFV=-3THENV=-1
360 BA=PEEK(S+H+22*(V-1)):C2=(PEEK(C+H+22*(V-1))AND15)
370 POKES+H+22*(V-1),4:POKEC+H+22*(V-1),2
380 POKES+H+22*(V-1),BA:POKEC+H+22*(V-1),C2
390 GOSUB560
400 RETURN
410 REM SNAKES
420 IFCT=0THENCD=1
430 POKESS+HS+22*VS,BS:POKECS+HS+22*VS,CD
440 GS=INT(RND(1)*4)+1
450 IFGS=1THENVS=VS-3:HS=HS+1:POKEFS+22*UP,32:FS=7991:F
    C=38711
```

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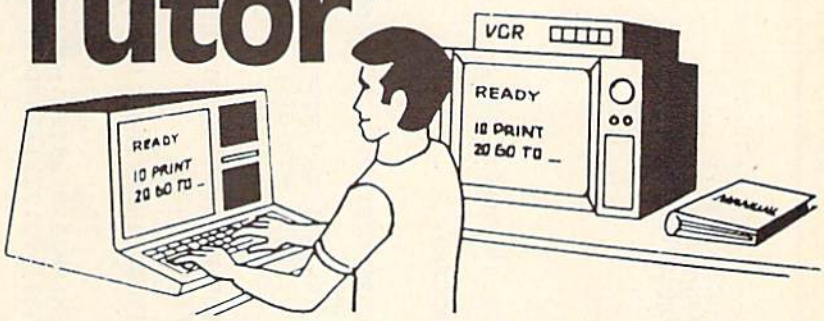

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Listing 2 continued.

```
460 IFGS=2THENHS=HS+1:IFL>2THENPOKEFS+22*UP,32:FS=7962:
    FC=38682
470 IFGS=3THENHS=HS-1:IFL>4THENPOKEFS+22*UP,32:FS=7840:
    FC=38560
480 IFGS=4THENVS=VS-3:HS=HS-1:IFL>6THENPOKEFS+22*UP,32:
    FS=7827:FC=38547
490 POKEFS+22*UP,6:POKEFC+22*UP,6
500 BS=PEEK(SS+HS+22*(VS-1)):CD=(PEEK(CS+HS+22*(VS-1))A
    ND15)
510 POKESS+HS+22*(VS-1),8:POKECS+HS+22*(VS-1),5
520 POKESS+HS+22*(VS-1),BS:POKECS+HS+22*(VS-1),CD
530 GOSUB790
540 RETURN
550 REM FALLING
560 V=V+1
570 IFV>16THENGOTO910
580 BA=PEEK(S+H+22*V):C2=((PEEK(C+H+22*V))AND15)
590 POKES+H+22*V,4:POKEC+H+22*V,2
600 PRINT"{HOME}"TAB(17)"{CTRL 9}LEVEL{2 CRSR DNs}{4 CR
    SR LFs}"L
610 IF((BA=0ORBA=1ORBA=3)ANDC2=1)THENCT=CT+1:CW=CW+1
620 IFBA=8THENCO=CO+100:CW=CW+100:TS=0:VN=0:GOSUB1310
630 PRINT"{HOME}{CTRL 9}SCORE{HOME}{2 CRSR DNs}{CRSR RT
    }"CW"":IFCT>54THENGOTO1380
640 IFCT+CO>AATHENBA=BS:GOTO1380
650 IFBA=6THENTS=0:VN=0:POKE36879,157:PRINT"{HOME}{CTRL
     9}{20 CRSR DNs}{25 SPACEs}"
660 IFBA=8THENTS=0:VN=0:POKE36879,157:PRINT"{HOME}{CTRL
     9}{20 CRSR DNs}{25 SPACEs}"
670 IFBA=1ORBA=3ORBA=0ORBA=6ORBA=7THENPOKE36874,200:FOR
    T=1TO200:NEXT:POKE36874,0:RETURN
680 POKES+H+22*V,BA:POKEC+H+22*V,C2
690 GOTO560
700 IFV=0THENRETURN
710 IFBA<>6THENRETURN
720 UP=UP-1
730 POKEFS+22*(UP+1),32
740 POKEFS+22*UP,6:POKEFC+22*UP,6
750 IFGS=1ORGS=2THENK=15:IFGS=3ORGS=4THENK=8
760 IFUP<-15THENPOKE36876,0:V=0:H=0:UP=0:POKEFS,6:BA=0:
    GOTO170
770 POKE36876,190-UP
780 GOTO720
790 VS=VS+1
800 IFVS>15THENVS=0:HS=0:CD=PEEK(CS):BS=1:RETURN
810 BS=PEEK(SS+HS+22*VS):CD=((PEEK(CS+HS+22*VS))AND15)
820 POKESS+HS+22*VS,8:POKECS+HS+22*VS,5
830 IFBS=0ORBS=1ORBS=3THENGOSUB1360
840 IFBS<>4THENGOTO870
850 IFBS=4ANDTS=0THENTS=20:VN=1:POKE36879,170
860 FORT=1TO100:POKE36877,255-T:NEXTT:POKE36877,0:POKES
    S+HS+22*VS,4:POKECS+HS+22*VS,2
870 IFBS=0ORBS=1ORBS=3THENRETURN
880 POKESS+HS+22*VS,BS:POKECS+HS+22*VS,CD
890 GOTO790
900 REM NOISE FALLING
910 POKE36878,15:FORT=1TO30
920 POKE36875,220-T
930 FORM=1TO30:NEXTM
940 NEXTT
950 POKE36875,0:FORL=1TO20:POKE36877,199+L:NEXTL:POKE36
    877,0
960 FORT=1TO1000:NEXTT:GOTO980
970 REM DEATH
980 POKE36879,8
990 PRINT"{CTRL 9}{SHFT CLR}{CTRL 2}{3 CRSR DNs}{2 CRSR
     RTs}KING TUT IS DEAD!!"
1000 PRINT"{3 CRSR DNs}{CTRL 9}{CRSR RT}EVEN THE MUMMY
     CAN'T  {{2 CRSR DNs}{2 CRSR RTs}SAVE HIM NOW!"
1010 PRINT"{2 CRSR DNs}{6 CRSR RTs}{CTRL 9}SCORE="CW
1020 POKE36875,0:TS$="00"
1030 POKE36878,15:FORM=1TO5:FORT=255TO128STEP-1:POKE368
     74,T:NEXTT:NEXTM:POKE36874,0
1040 GOTO1120
1050 POKE36874,200:FORT=1TO200:NEXT:POKE36874,0
1060 RETURN
1070 REMJOYSTICK
1080 POKEDD,127:S3=-((PEEK(PB)AND128)=0):POKEDD,255
1090 P=PEEK(PA):S1=-((PAND8)=0):S2=((PAND16)=0):S0=((PA
     ND4)=0)
1100 FR=-((PAND32)=0):X=S2+S3:Y=S0+S1:RETURN
1110 FS=4407:FC=38199:SS=4129:CS=37921:S=4128:C=37920:R
     ETURN
1120 PRINT"{SHFT CLR}":POKE36879,25
1130 PRINT"{CTRL 9}{2 CRSR DNs}{4 CRSR RTs}{CTRL 1}{CTR
     L 3}{5 SPACEs}THE"
1140 PRINT"{CTRL 9}{CRSR DN}{3 CRSR RTs}SERPENT OF DEAT
     H"
1150 FORB=0TO22:POKEB+7680,8:POKE38400+B,5:NEXTB
1160 FORB=0TO22:POKE7702+B*22,8:POKE38422+B*22,5:NEXTB
1170 FORB=0TO22:POKE7723+B*22,8:POKE38443+B*22,5:NEXTB
1180 FORB=0TO20:POKE8165+B,8:POKE38885+B,5:NEXTB
1190 PRINT"{CTRL 9}{2 CRSR DNs}{6 CRSR RTs}{CTRL 1}STAR
     RING:{CRSR DN}"
1200 PRINT"{CTRL 1}{CRSR DN}{6 CRSR RTs}{CTRL 9}KING TU
     T{CTRL 0}{CRSR RT}  {CTRL 3}D {CTRL 7}"
1210 PRINT"{CTRL 1}{CRSR DN}{5 CRSR RTs}{CTRL 9}THE MUM
     MY{3 SPACEs}{CTRL 7}{CTRL 0}F"
1220 PRINT"{CTRL 1}{CRSR DN}{5 CRSR RTs}{CTRL 9}MS. COB
     RA{3 SPACEs}{CTRL 6}{CTRL 0}H"
```

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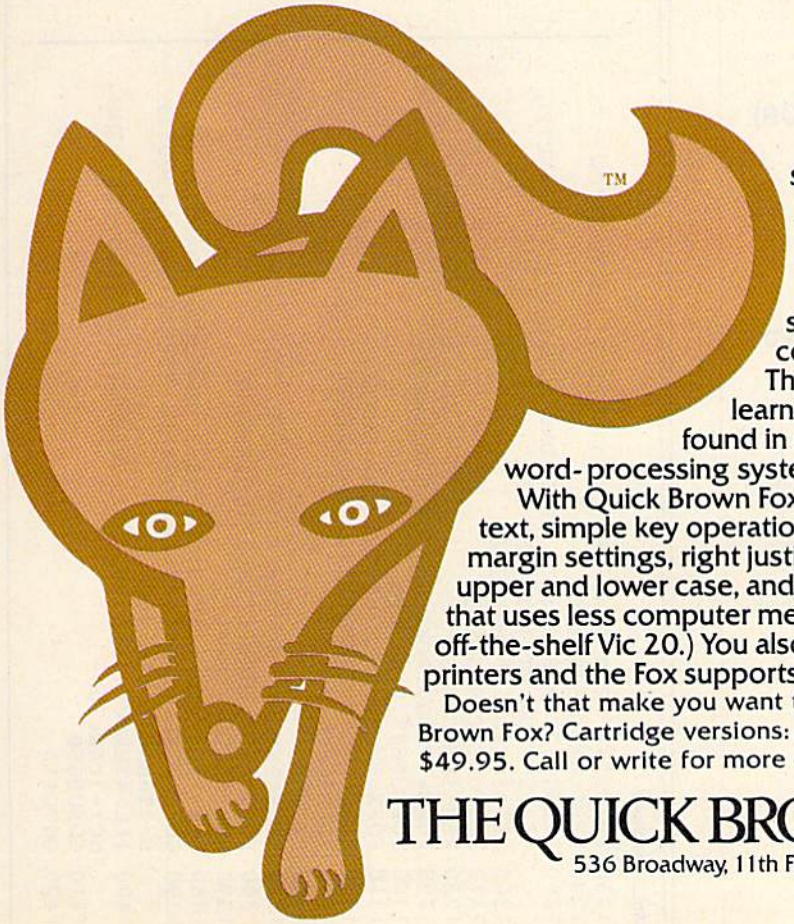

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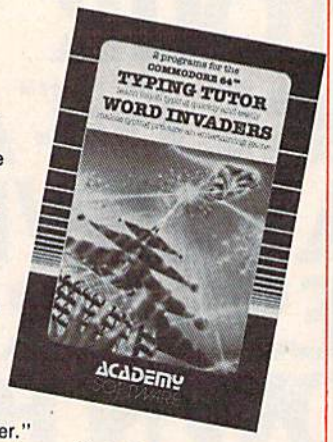

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Listing 2 continued.

```
 1230 PRINT"{4 CRSR RTs}{CRSR DN}{CTRL 9}   SCORE="CW
 1240 RESTORE:GOSUB1430
 1250 PRINT"{2 CRSR RTs}{2 CRSR DNs}{CTRL 9}{SPACE}{CTRL
      5}{2 CRSR RTs}HIT ANY KEY"
 1260 GETA$:IFA$=""THEN1260
 1270 RESTORE:CLR:GOTO30
 1280 REM SNAKE HISS
 1290 FORT=1TO100:POKE36877,255-T:NEXTT
 1300 POKE36877,0:RETURN
 1310 FORX=1TO90:POKE36874,128+X:NEXTX
 1320 FORX=1TO90:POKE36874,218-X:NEXTX
 1330 POKE36874,0
 1340 RETURN
 1350 REMSNAKE HIT SQUARE
 1360 POKE36877,200:POKE36877,0:RETURN
 1370 REM HARDER LEVEL
 1380 L=L+1:CT=0:CO=0:V=0:H=0:VS=3:HS=0:CD=1:BA=0:BS=3
 1390 CD=C1:IFL>1THENC1=3:AA=200:IFL>2THENC1=6:AA=300:IF
      L>3THENC1=5:AA=400
 1400 IFL>4THENC1=4:AA=500:IFL>5THENC1=2:AA=600:IFL>6THE
      NC1=7:AA=700
 1410 GOSUB650
 1420 GOTO110
 1430 POKE36878,15:B=.4
 1440 FORI=0TO2:FORJ=0TO2:READJS(J,I):NEXTJ,I
 1450 READQ,R
 1460 IFQ=0THENRETURN
 1470 POKE36876,Q
 1480 T=TI+B*R
 1490 IFTI<TTHEN1490
 1500 POKE36876,0
 1510 GOTO1450
 1520 DATA7,0,1,6,8,2,5,4,3
 1530 DATA195,45,201,45,203,99,201,99,195,99,195,45,201,
      45
 1540 DATA203,45,215,45,201,45,203,45,195,80,195,5,201,5
      ,207,5,209,5,215,5,219,5,223,5
 1550 DATA225,5,0,0
```

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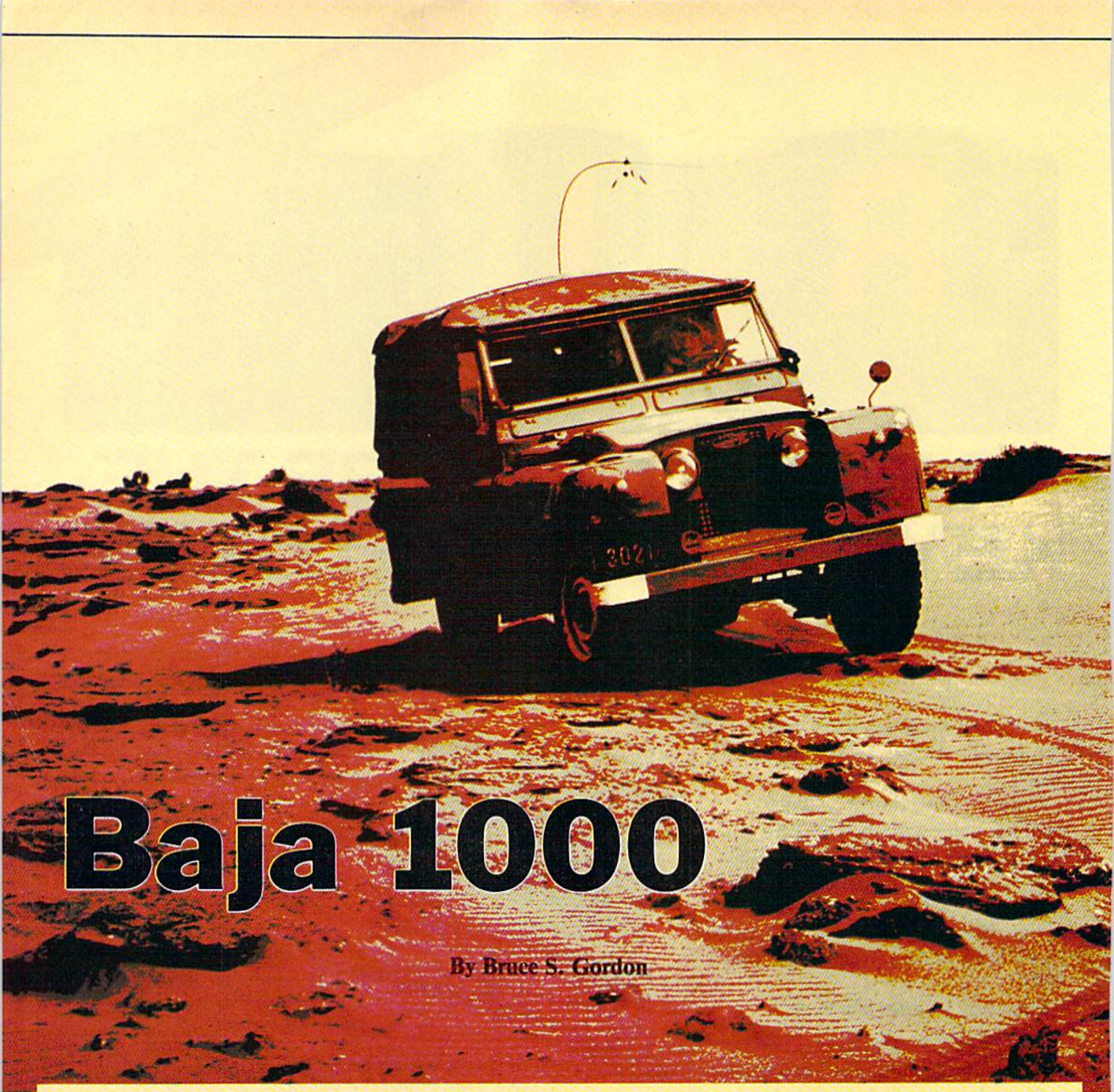

Baja 1000

By Bruce S. Gordon

In Baja 1000, an arcade-style game for the unexpanded VIC-20, you drive your 4×4 pickup across rough terrain and try to escape ruthless pursuers, who are in a helicopter with heat-seeking bombs.

If you can switch your exhaust from down on the ground to up in the air, you will confuse the heat-seeking capabilities of the bombs. If you can avoid the ditches and the giant cactus plants, you might make it to safety.

The space bar sends your truck into the air, which enables you to jump the ditches and the cacti. The F7 key switches your exhaust to confuse the heat-seeking bombs that are carefully dropped from the helicopter. The letter at the bottom of the screen helps you keep track of your mileage.

The course has four sections, A through D. The course listed is medium tough, and I'll teach you also how to write a more difficult one, in case this is too easy for you. (Or you may want to make it easier—for your little sister, of course.)

This program illustrates one of the most powerful features of Microsoft Basic—its ability to create graphics animation. As a beginning programmer, you soon discover that Poking your animated graphics on the screen brings the action almost to a halt.

At this point, people too often give up on Basic and turn to Forth or As-

RUN It Right

Unexpanded VIC-20

Address author correspondence to Bruce S. Gordon, 701 S. 11th St., Herrin, IL 62948.

You must battle the elements and evade ruthless pursuers to survive this rugged course. Or else you'll end up as buzzard's bait.

sembly Code. They fail to recognize that printing strings in Basic is very close to a machine language memory move. The interpreter still has to keep track of a lot of things and do a lot of jumping around, but it's remarkably fast.

To see how fast this technique is, try the following program and refer to your manual if you don't understand how it works.

```
10 A$="(22 spaces) B (22 spaces)"
20 FORI=1TO23
30 PRINT CHR$(19) MID$(A$,I,22)
40 NEXTI
50 GOTO20
```

Now add this appropriate time delay so you can see the B run across the screen:

```
35 FORT=1TO100: NEXT
```

You might say that you could make the B go that fast by using Pokes, but remember we're not just putting up one character with this program; we're printing 22 characters, each of which could be different. We could add different colors too, and it will go just about as fast.

With Poking you need to Poke both screen and screen color memory, and if you want to shift in and out of multicolor mode, you'll see that speedwise, Poking just can't compete with printing. Try this program and then try to accomplish it with Poking.

```
10 A$=" [color black] * [color red] *
   [color cyan] * [color purple] * [color
   green] * [color blue] * [color yellow] *
   (each color change and symbol
   should be separated by two spaces)
15 A$=A$+A$+A$+A$
20 FORI=1TO90
25 PRINT CHR$(19) MID$(A$,I,28)
30 FORT=1TO90:NEXT
40 NEXTI
50 GOTO20
```

This is the basic technique used to move the ground underneath the truck; a separate string moves the cacti along the outcropping of the turf. When we combine this with the mult-color graphics capabilities, you'll see that the truck wheels follow the ups and downs of the ground without a single Peek and only two Pokes.

The wheels, formed atop each piece of turf, are formed in multi-color mode in a character color the same as the screen color so that you can't see the wheel part. Then, by Poking the color memory at the location below the truck wheel-wells to a black character color, the black tires appear, and always right on the ground.

If you change POKE 646,9 in line 120 to POKE 646,8, you will see that the tires are there all the time, just invisible. Combining these two techniques allows elaborate side scrolls with reasonable speed.

The course you drive in Baja 1000 is composed of four strings—B$(1-4). These strings are scrolled with a For... Next loop beginning in line 110 and printed in line 120.

B$s are in turn composed of differing combinations of A1$, A2$ and A3$. Each B$, formed in lines 585 and 586, is made of four substrings. The substrings can be found in lines 580–583. They are composed of @, A, B, C, D and Es.

These specially created graphics characters make up the ground (and the tires). A "@" is a complete block, and an "A," an empty space. The others range in between. In these substrings, the As are the ditches, the @s will sprout cacti if there are not already cacti on the screen, and the others cause the undulations of the ground.

I encourage you to create new courses, especially after you master this one. The rules for creating the strings are simple. A1$ should start each B$. A2$ should end each B$. The first 22 characters of A1$ should be the same as the last 22 characters in A2$. I don't like the terrain too rough, so I usually just move to the next letter, and I like to avoid ditches in the first 22 characters of A1$ so the poor guy doesn't crash right away. But aside from that, you can create both easy and difficult courses. Just change those 63 character strings around and enjoy a new challenge.

The program comes in two parts and should be saved on tape, one right after the other. The first program reserves a section of memory for special characters, and then Pokes data into the memory to create the special characters. Use of special characters gives this program a high-resolution graphics appearance.

The program uses double-high characters, which are eight pixels wide and 16 pixels deep. This is the reason the data is arranged in sixteens. If you wish to vary any of the special characters—for instance, change the pickup truck into a Bronco—it should be easy to find your way. This first data statement creates the @, the second the A, the third the B and so on. The rest of the first program displays some simple directions and automatically loads the second part.

When typing in the second part of the program, you should enter line one as GOTO 510. This will prevent the program from going into double-high character mode as well as from shifting to custom characters. The program may look like the war of the alphabet, but it will let you find your errors, as the error

```
501 POKE52,28:POKE56,28:CLR
510 FORQ=7168TO7168+26*16-1:READA:POKEQ,A:NEXT
515 PRINT"{SHFT CLR}{3 CRSR DNs}{6 SPACEs}DIRECTIONS":P
    RINT"{2 CRSR DNs}{2 SPACEs}{CTRL 9}SPACE BAR{CTRL
    0}{3 SPACEs}MAKES{6 SPACEs}YOUR TRUCK JUMP"
516 PRINT"{2 CRSR DNs}{2 SPACEs}{CTRL 9}F7{CTRL 0} SWIT
    CHES EXHAUST":PRINT"{CRSR DN} JUMP DITCHES,CACTII"
517 PRINT"{CRSR DN}{2 SPACEs}SWITCH EXHAUST TO"
518 PRINT" CONFUSE HEAT-SEEKING","{6 SPACEs}BOMBS"POKE6
    31,131:POKE198,1
520 DATA85,85,85,85,85,85,85,85,85,85,85,85,85,85,85

521 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
522 DATA0,32,32,136,136,136,32,32,85,85,85,85,85,85,85,
    85
523 DATA32,136,136,136,32,32,85,85,85,85,85,85,85,85,85
    ,85
524 DATA136,136,32,32,85,85,85,85,85,85,85,85,85,85,85,
    85
525 DATA32,32,85,85,85,85,85,85,85,85,85,85,85,85,85,85

526 DATA0,0,0,0,0,0,0,7,4,15,15,15,14,30,0,0
527 DATA0,0,0,0,0,0,0,254,146,255,255,135,51,121,252,25
    2
528 DATA0,240,136,132,130,194,205,255,255,255,255,255,2
    54,254,0,0
529 DATA0,0,0,0,0,0,192,254,254,255,135,123,253,253,252
    ,252
530 DATA0,0,0,0,0,16,16,16,80,84,84,92,112,16,24,126
531 DATA0,48,120,204,204,204,120,48,0,0,0,0,0,0,0,0
532 DATA254,4,4,126,147,147,255,255,127,62,16,0,0,0,0,0

533 DATA16,0,0,0,0,130,197,242,156,0,0,0,0,0,0,0
534 DATA143,4,4,126,147,147,255,255,127,62,16,0,0,0,0,0

535 DATA240,0,0,0,0,133,192,245,156,0,0,0,0,0,0,0
536 DATA0,128,160,160,192,176,204,242,253,119,203,203,1
    23,49,0,0
537 DATA0,0,4,10,17,33,113,253,254,255,255,255,255,254,
    252,60
538 DATA0,0,0,0,0,0,0,64,234,255,251,255,59,31,202,47
539 DATA0,0,60,195,0,0,60,195,0,0,60,195,0,0,60,195
540 DATA4,22,30,31,63,63,63,63,31,31,30,30,14,14,14,4
541 DATA68,84,40,16,56,56,56,56,16,0,0,0,0,0,0,0
542 DATA65,65,0,0,20,20,20,0,0,20,20,20,20,20,20,20
543 DATA1,0,16,20,20,20,16,1,1,16,20,20,20,16,0,1
544 DATA65,0,4,20,21,21,21,21,21,21,21,21,20,4,0,65
545 DATA1,0,16,20,20,20,20,20,20,20,20,20,20,16,0,1
```

Listing 1. Part 1 of the Baja 1000 program.

Listing 2. Part 2 of the Baja 1000 program.

```
1 GOTO500
85 POKEV-22,19:POKEV+K-22,10:POKEV,21:POKEV+K,0:V=V+22:
    POKESN,200:C=1
86 IFV=7904THENPRINTF$;"{CRSR UP}AAAA":GOTO300
87 RETURN
110 FORQ=1TO4:POKE7924,21+Q
115 FORW=1TO230
120 POKE646,9:PRINTD$;MID$(B$(Q),W,22)
122 POKE38622,WC:POKE38624,WC
125 IFCA<26THENPRINTD$;"{CRSR UP}";MID$(CA$,CA,23):GOTO
    130
127 IFPEEK(7920)=0THENCA=1
130 PRINT"{HOME}{CTRL 3}"SPC(X+22)"ANOA":POKESN,200
```

More

This program is not only fun to play; it should also inspire some experimentation.

messages come up in English instead of fragmented truck parts. When all seems to be working, then enter GOTO 500. I left out REM statements because there isn't enough memory in the unexpanded VIC, but the chart in Table 1 will help you.

Routines

The main game loop statements are in the first part of the program.

Lines 85–87: a subroutine that drops the bomb and checks for a hit.

Lines 200–250: the end of the game.

Lines 250–300: the Hit a Cactus routine.

Lines 300–400: the crash routine.

Lines 480–481: the data that moves the helicopter.

Lines 500 and on: just initialization.

The program is full of tricks I learned from many hours of programming bookkeeping, database and word processing programs, so it may contain some new things for game makers. It should not only be fun to play, but hopefully, it will inspire some experimentation, too.

If you don't want to type in the program yourself, I'll supply you with a copy if you send me a blank cassette with a self-addressed stamped mailer and $3. R

V—	the location of the bomb
CA—	the position in the cactus string
D—	the control variable for the jumping truck
C—	a control variable to poke out final bomb display
WC—	tire color, either white or black
SN—	noise voice location
SV—	volume location (also auxiliary color)
D$—	homes and then comes down to road level
S$—	a line of solid blocks
F$—	homes and then goes to the normal location of the truck
CA$—	a series of cursor rights, a cactus and then more cursor rights

Table 1. Explanations of the variables used in the Baja 1000 program.

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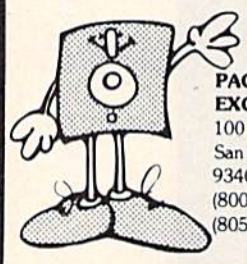

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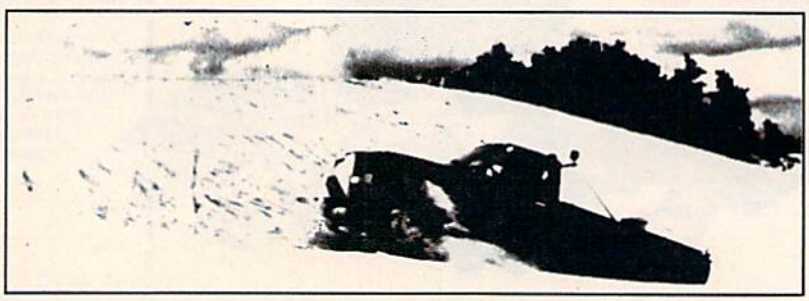
Listing 2 continued.

```
160 IFDTHENPRINTF$;"{CRSR UP}{CTRL 7}FGHI":PRINT"{CTRL
    1}AAKAK":WC=9:D=D-1:B=1:GOTO180
165 IFBTHENPRINTF$;"{CRSR UP}AAAA":WC=8:B=0
170 PRINTF$;"{CTRL 7}FGHI":IFPEEK(197)=32THEND=6
175 IFPEEK(7904)=1GOTO300
177 IFPEEK(7883)=10THENGOSUB250
180 READX:IFX=77THENPRINTCHR$(19)SPC(20)"AAA":RESTORE:G
    OTO180
182 PRINT"{HOME}{CTRL 3}"SPC(X+22)"ALMAA"
185 IFX=3THENIFPEEK(36878)=26THENGOSUB85:GOTO189
188 POKESN,0:IFCTHENPOKESV,26:POKEV-22,19:POKEV+K-22,10
    :V=7750:C=0
189 IFPEEK(197)=63THENIFD=0THENPOKESV,42:C=1:IFX=3THENR
    EADX:GOTO189
190 CA=CA+1
199 NEXT:NEXT
200 PRINT"{SHFT CLR}":POKE36869,240:POKE36867,PEEK(3686
    7)AND254
210 PRINT"{4 CRSR DNs}{3 CRSR RTs}CONGRATULATIONS":END
250 FORI=16TO31STEP.3:POKESV,I:POKESN,249
254 FORI=16TO31STEP.3:POKESV,I:POKESN,249
260 IFI>24THENPOKE7860,20:POKE7860+K,0
280 FORT=1TO40:NEXT
285 NEXT:FORT=1TO2000:NEXT
295 POKE7860,1:POKESN,0:POKESV,26:RETURN
300 POKESV,31:POKESN,200
305 POKESV,31:POKESN,200
310 PRINTF$;"{CTRL 7}AFGHI"
311 POKE38622,9
320 FORT=1TO200:NEXT
330 FORS=31TO16STEP-1
332 POKESV,S:POKE36876,0:POKE36877,135
340 PRINTF$;"AAAAAA{CRSR DN}{3 CRSR LFs}{CTRL 7}APQR{CR
    SR UP}{CRSR LF}{CTRL 1}T"
360 FORT=1TO100:NEXT
370 NEXT:POKE36877,0:RUN
480 DATA19,19,18,18,17,17,16,16,15,15,14,14,13,13,12,12
    ,11,10,10
481 DATA9,9,8,8,7,7,6,6,5,5,4,4,3,3,3,3,3,3,3,3,2,1,0
    ,-1,-2,77
500 POKE36869,255:POKE36867,PEEK(36867)OR1:POKE36879,31
510 K=30720
580 A1$="CCDEDCBCDEDCBDE@EDCDE@EDBDDCBCDEDAAAADCBCBCDED
    BDEDE@ECBCBCCBCDC"
582 A2$="CCDEDCBCDEDCBDE@EDCDCBAAAADCBCDEDEDEDE@EDDCDED
    CBCDEDCBDE@EDCDED"
583 A3$="CCAAAABCDE@EDDE@EDCDCBAAAADCBCDEDEDEDAAAABCDED
    BDE@ECECBCBCCBCDC"
585 B$(1)=A1$+A2$+A1$+A2$:B$(2)=A1$+A2$+A1$+A2$
586 B$(3)=A1$+A2$+A3$+A2$:B$(4)=A1$+A3$+A2$+A3$
590 D$="{HOME}{10 CRSR DNs}":F$=LEFT$(D$,10)+"{CRSR RT}
    "
592 CA$="{19 CRSR RTs}{CTRL 6}AJAA{22 CRSR RTs}"
594 S$="@@@@@@@@@@@@@@@@@@@@@@"
595 POKE646,10:PRINT"{SHFT CLR}";D$;S$;S$;S$:WC=8:CA=26
    :X=19:V=7728:SV=36878:SN=36877
597 PRINT"{HOME}":FORI=1TO8:PRINT"AAAAS":NEXT:POKESV,26
598 PRINTF$;"{CTRL 3}FGHI"
599 GOTO110
```



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VICTREE has 14 commands that permit the greatest program writing and fixing ease. For writing, the toolkit of commands includes FIND and CHANGE (the programmer's search and replace), which simplifies making changes in your program. The RENUMBER command offers helpful timesaving, by removing the drudgery of line renumbering.
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Scaling Ivy-Covered Walls

C-64 Gives College-Bound A Boost

By Kenneth L. Ecton

In the process of selecting a few appropriate colleges to apply to, high school students are often bewildered in trying to assay the relative qualities of the several thousand they have to choose from. If you are such a student, your final question naturally has to be, "Which college is best suited to *my* individual interests and skills?"

No one can answer that query for you, but what this program does is let you use your Commodore 64 to sift through some of the statistical data reported by colleges about themselves. You can then examine a selection of colleges in a ranked order determined by the chosen factors.

The program was written using a Commodore 64, but it is designed to allow for easy portability to other Basic systems. The program alone will require at least 9K of memory, and, depending on the number of colleges entered, the file handling will increase the memory requirement.

Variables and Values

Seven categories (variables) are developed that ask you for an input of values. You can find the data for these variables in a variety of resource books available in public libraries, book stores and school counseling offices and libraries. The one I found most beneficial is Barrons' *Profiles of American Colleges, Vol. 1.*

After selecting a college and entering the program, you locate the requested statistic in the resource book and enter that value when prompted. The program will continue to prompt for data until all variables have been entered.

The program then assigns each variable a rating score (1–5) and displays the college, variable and rating score, along with an appropriate color on the border. All variables are then summed and the total rating score for that particular college is displayed.

You may save the score of that college, have the files sorted and then display the total-score ranking of all colleges entered, from highest to lowest. Or, you may select a single variable and compare all entered colleges using that variable.

The variables in the program are:

- Freshman dropout rate
- The percent of entering freshmen who graduated
- The percent of freshmen who continued on to graduate or professional school

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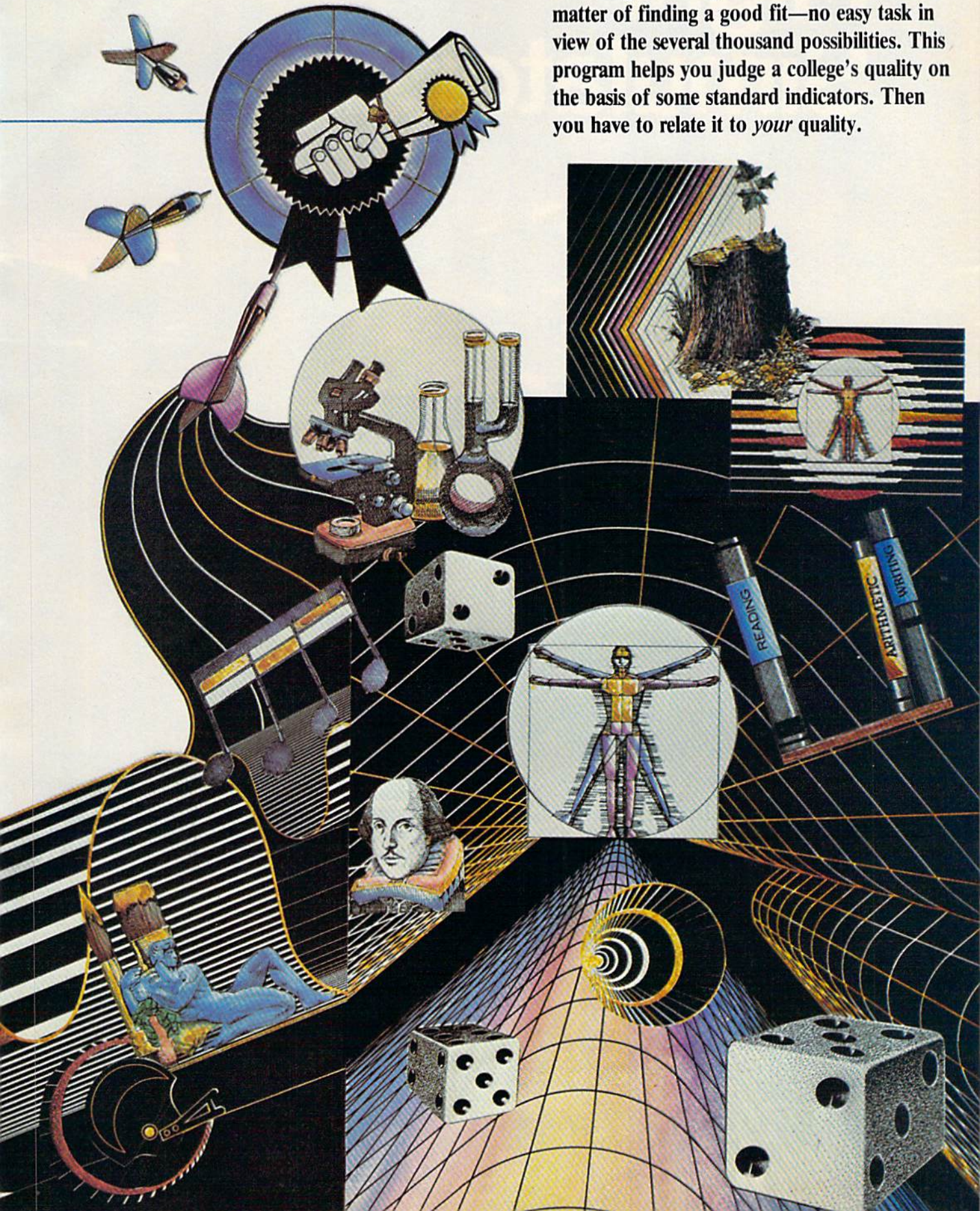
Address author correspondence to Kenneth L. Ecton, 101 North Hayes, Moscow, ID 83843.

Choosing the college that will choose you is a matter of finding a good fit—no easy task in view of the several thousand possibilities. This program helps you judge a college's quality on the basis of some standard indicators. Then you have to relate it to *your* quality.



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Lines 9–22	Introduction/Instructions
26–39	Menu to choose program options
40–188	Input of college variables
109–502	Rating value assessment with subroutine location
600–999	Subroutine to assign ranking scores to variable input
1000–1040	Subroutine for color assignments to ranking scores
1050–1062	Subroutine for saving data to disk files
2060–4310	Subroutine for sorting files on total score
4900–6050	Subroutine for sorting files on chosen variable
7000–7410	Subroutine for sorting files alphabetically

Table. Summary of sections of Choosing a College program.

Listing of Choosing a College program.

```
0 REM ********************************
1 REM ***     CHOOSE A COLLEGE     *****
2 REM ***     KEN ECTON            *****
3 REM ***     101 N HAYES          *****
4 REM ***     MOSCOW, ID 83843     *****
5 REM ********************************
6 DIMA$(99)
7 PRINT"{SHFT CLR}":REM CLEAR SCREEN
8 PRINT:PRINT:PRINT"DO YOU WISH INSTRUCTIONS  (Y/N)?"
9 GET IN$:IFIN$=""THEN9
10 IFIN$="N"THEN23
11 PRINT"THIS PROGRAM WILL ASK FOR INFORMATION ON A COL
     LEGE OF YOUR CHOICE."
12 PRINT"YOU WILL ENTER DATA ON THE KEYBOARD."
13 PRINT"DIFFERENT CATAGORIES WILL BE EVALUATED AND A N
     UMERICAL AND COLOR"
14 PRINT"RATING ASSIGNED AS FOLLOWS:..(BEST TO BAD)"
15 PRINTTAB(10)"{CRSR DN}{CRSR DN}5...";:GOSUB 1000
16 PRINTTAB(10)"{CRSR DN}{CRSR DN}4...";:GOSUB 1010
17 PRINTTAB(10)"{CRSR DN}{CRSR DN}3...";:GOSUB 1020
18 PRINTTAB(10)"{CRSR DN}{CRSR DN}2...";:GOSUB 1030
19 PRINTTAB(10)"{CRSR DN}{CRSR DN}1...";:GOSUB 1040
20 POKE 53280,14
21 PRINT"{CRSR DN}{CRSR DN}{CTRL 9}HIT ANY KEY TO CONTI
     NUE{CTRL 0}"
22 GET CC$:IF CC$=""THEN 22
23 PRINT"{SHFT CLR}":REM CLEAR SCREEN
24 PRINT:PRINT:PRINT"WHAT DO YOU WISH TO DO?":PRINT:PRI
     NT
25 PRINTTAB(05)"{CTRL 9}ENTER A COLLEGE{CTRL 0} C":PRIN
     T
26 PRINTTAB(05)"{CTRL 9}REVIEW A PREVIOUS CATAGORY{CTRL
      0} V":PRINT
27 PRINTTAB(05)"{CTRL 9}REVIEW RANKED PREVIOUS ENTRIES{
     CTRL 0} R":PRINT
28 PRINTTAB(05)"{CTRL 9}REVIEW AN ALPHABETI{Z}ED LIST{C
     TRL 0} A":PRINT
29 PRINTTAB(05)"{CTRL 9}QUIT{CTRL 0} Q"
30 GET II$:IF II$=""THEN 30
31 IF LEFT$(II$,1)="C"THEN40
32 IF LEFT$(II$,1)="R"THENGOSUB2000:GOTO23
33 IF LEFT$(II$,1)="V"THENGOSUB4900:GOTO23
34 IF LEFT$(II$,1)="A"THENGOSUB7000:GOTO23
35 IF LEFT$(II$,1)="Q"THEN590
38 NM$=LEFT$(II$,1)
39 IF NM$<>"C"ORNM$<>"R"ORNM$<>"V"ORNM$<>"A"ORNM$<>"Q"T
     HEN23
40 PRINT "{SHFT CLR}{HOME}"
41 PRINT"ENTER THE NAME OF THIS COLLEGE":INPUT A$
42 IF LEN(A$)>16 THEN GOSUB 592
46 IF LEN(A$)=16 THEN 49
47 A$=A$+CHR$(32):GOTO 46
49 PRINT "{SHFT CLR}{HOME}"
```

More

- Student/faculty ratio
- Faculty salary level
- The percent of faculty with Ph.D.s
- The freshman acceptance rate

The file display has a timing loop to slow down the Print statement, allowing you to study the ranking order as presented. When the screen becomes full on the C-64, you should press the stop key if you wish to halt the program to study the full screen. When you're ready to continue, enter the CONT command, and the file will continue to scroll on the screen until the end (or until stopped again). Also, the screen output on the C-64 can be slowed further by holding the control key down.

I should caution again that this program doesn't give the whole answer. One very important item, for example, is not included—tuition cost. The program simply investigates how colleges compare in quality as revealed by the seven factors. Once that is known, the other variables of cost, geography, personality, individual academic offerings and so on, would be weighed.

You should consider the results of any assessment using this program only together with other published reports of a school's quality. The program is only one more tool to help you locate the school most nearly meeting your particular needs and desires.

Some Underlying Assumptions

The school data is reported in a standardized manner. This is admittedly a cautious assumption, since, for example, some schools may include graduate student instructors in student/faculty ratios, but exclude them from calculations as to the percent of faculty with doctorates. Since there is a possibility of non-standard reporting, the data can only be considered an indicator of a particular school.

A school with a low rate of acceptance (high competition) and a low percentage of freshman dropouts could be assumed to do a good job of recruiting and selecting the student body. Similarly, if a large percentage of incoming freshmen remain until graduation, then you might infer that there is good rapport between students, faculty and within the educational process as a whole at that school.

If, in addition, there were a large number of graduates from this particular school who successfully continued their education at the graduate or professional level, you might conclude that this school also has capable, moti-

Listing continued.

```
130 INPUT "ENTER THE FRESHMAN DROPOUT RATE ";DR
140 INPUT "{CRSR DN}{CRSR DN}INPUT THE % OF FRESHMAN WH
    O GRADUATED.";GR
145 PRINT"{CRSR DN}{CRSR DN}ENTER THE % OF GRADUATES TH
    AT CONTINUED"
146 INPUT" ON TO PROFESSIONAL OR GRADUATE SCHOOL";G
150 PRINT"{CRSR DN}{CRSR DN}ENTER THE STUDENT/FACULTY R
    ATIO"
151 INPUT"(JUST THE 1ST NUMBER...14:1..USE 14)";SF
155 PRINT"{CRSR DN}{CRSR DN}ENTER FACULTY SALARY LEVEL.
    .."
156 INPUT" USING..++/+/SPACE FOR AVG/-/--";F$
160 INPUT "{CRSR DN}ENTER THE % OF FACULTY WITH PHD ";P
    H
169 PRINT"{SHFT CLR}"
170 INPUT "{CTRL 9}ENTER THE NUMBER OF APPLICATIONS ";A
    P
171 INPUT "{CRSR DN}{CRSR DN}{CTRL 9}ENTER APPLICANTS A
    CCEPTED ";AC:IFAP>ACTHEN174
172 PRINT:PRINT:IFAC>APTHENPRINT"NEED MORE APPLICATIONS
     THAN ACCEPTED "
173 FORLL=1TO1500:NEXTLL:GOTO169:REM TIMEING LOOP FOR E
    RROUNEOUS ENTRY
174 PRINT"IF YOU WISH TO CHANGE LEVEL OF ACCEPTANCE STA
    NDARD,ENTER YOUR CHOICE"
175 PRINT"...OTHERWISE 33% WILL BE EVALUATED (IF  NO CH
    ANGE HIT RETURN)"
176 AA=33:INPUT AA
177 B=AC/AP
178 B=B*100
179 PRINT:PRINT"THE RATE OF ACCEPTANCE IS{SHFT SPACE}"B
    "{CRSR DN}{CRSR DN}"
180 IF B<AA GOTO 182
181 IFB>AA GOTO 183
182 T=INT(AA-B):GOTO186
183 H=INT(B-AA):GOTO188
184 PRINT"THE RATE OF ACCEPTANCE IS{SHFT SPACE}"B
186 PRINT "THE ACCEPTANCE RATE IS "T" % BETTER   THAN Y
    OUR STANDARD.{CRSR DN}{CRSR DN}":GOTO190
188 PRINT"THE RATE  OF ACCEPTANCE IS "H"% WORSE   THAN
    YOUR STANDARD."
190 GOSUB 600
191 PRINT"THE RATING VALUE FOR "A$ " FOR ACCEPTANCE RAT
    E IS {CTRL 9} ";X:PRINT"{CTRL 0}"
192 PRINT"{4 CRSR DNS}{CTRL 9}HIT ANY KEY TO CONTINUE"
193 GETV$:IF V$="" THEN 193
194 PRINT"{SHFT CLR}":POKE 53280,14:REM CLR SCRN AND RE
    STORE SCRN COLOR
270 PRINT"{SHFT CLR}"
271 GOSUB 700
272 PRINT"THE RATING VALUE FOR "A$" FOR FRESHMAN DROPOU
    T RATE IS ";W:PRINT"{CRSR DN}{CRSR DN}"
273 GOSUB 760
274 PRINT"THE RATING VALUE FOR GRADUATING FRESHMAN IS {
    CTRL 9}";Y:PRINT"{CTRL 0}{CRSR DN}{CRSR DN}"
275 GOSUB 820
276 PRINT"{CRSR DN}THE RATING VALUE FOR GRADUATES CONTI
    NUING IS {CTRL 9}";V:PRINT"{CTRL 0}{CRSR DN}{CRSR
    DN}"
278 GOSUB 997
280 GOSUB 880
281 PRINT"THE RATING VALUE FOR STUDENT FACULTY RATIO IS
     {CTRL 9}";U:PRINT"{CTRL 0}{CRSR DN}{CRSR DN}"
285 GOSUB 940
286 PRINT"THE RATING VALUE FOR FACULTY SALARIES IS {CTR
    L 9}";K:PRINT"{CTRL 0}{CRSR DN}{CRSR DN}"
290 GOSUB 960
291 PRINT"THE RATING VALUE FOR FACULTY PHD IS {CTRL 9}"
    ;DD:PRINT"{CTRL 0}{CRSR DN}"
499 GOSUB 997
500 PRINT"{SHFT CLR}" :TL=X+W+Y+V+U+K+DD
502 PRINT"THE TOTAL RATING VALUE FOR "A$" IS ";"{CTRL 9
    }"TL "{CTRL 0}"
```

More

vated students who receive a high quality education.

Program Details

A description and information screen is given, followed by the menu-driven opportunity to enter new data or to go to the file and sort routines. The rating values (lines 600–970) were established after searching for high and low values of each variable, finding a median and establishing limit structures from there.

You could list the program and recode the variable values in any area to either increase or decrease the discriminant points of that variable. One variable, the acceptance rate, may be changed with the program running. The default is for a 33 percent acceptance rate, but at the prompt, it may be changed (line 173).

Also, at the end of each rating assignment, a jump subroutine (lines 1000–1040) goes to a border color change visually reflecting the quality of the rating (i.e., red indicates the worst rating...1).

The file management (naming, saving and loading) is written for the Commodore 1541 disk drive and may be changed as appropriate for another system or for cassette use (lines 1050, 1056, 5004 and 7008). The current programming for file management uses a sequential file convention. The program (line 1056) adds the newest entry to the end of an existing file.

Because the 1541 recognizes the entire block of data as a single string (A$), only that variable is used in the file management routine. In lines 42–47, the string is formatted so that the first 16 spaces are for the college's name or are embedded blank spaces.

The sort routines are a slightly altered Shell-Metzner sort algorithm. The total score sort is run on the last three bits of the string A$ (the total rating value, line 2090). You are then given an opportunity (lines 2002–2015) to select an option to see all schools' evaluations in descending ranking; to review only those colleges with scores of 25 or better (rating value of 4 or 5); or to specify what parameters you want to see (e.g., only schools with a score of 23).

Another sort routine is coded so that you can establish which variable field (e.g., student/faculty ratio) the sort is to index on. The string is then reduced to that chosen field (line 5090).

Finally, at line 7000 a sorting subroutine code arranges the entire file alphabetically, thus allowing the user

to determine quickly whether a college of interest has been previously evaluated.

The program is dimensioned (line 4) for 99 records. If you expect to enter and compare more than 100 colleges, the DIM statement would need to be altered accordingly.

The subroutine at lines 1050–1060 may be of interest to Commodore users as a separate utility program, to be filed away for future use. Lines 1050 and 1054 are standard writing to (establishing) sequential file commands. However, line 1056 opens an already established file, but then appends new information to the end of the file.

This is a feat that supposedly can't be done with the C-64/1541 disk pairing. Likewise, the first five lines of the sort subroutines (lines 2002–2016) are worth noting for Commodore users. This code retrieves a string from the disk file and creates an array. This particular section of coding caused me a lot of effort to figure out, and I would therefore suggest that it also may be of interest as a separate utility file.

If you'd rather not spend the time typing in this lengthy program, I'll provide copies on the appropriate media. Just send me a self-addressed stamped envelope of the correct size for either disk or tape mailing and $3. R

Listing continued.

```
 510 PRINT:PRINT"FOR COMPARISON THE RANGE IS......."
 511 PRINTTAB(10)"{CRSR DN}{CRSR DN}35-28..";:GOSUB 1000
 512 PRINTTAB(10)"{CRSR DN}{CRSR DN}27-24..";:GOSUB 1010
 513 PRINTTAB(10)"{CRSR DN}{CRSR DN}23-19..";:GOSUB 1020
 514 PRINTTAB(10)"{CRSR DN}{CRSR DN}18-13..";:GOSUB 1030
 515 PRINTTAB(10)"{CRSR DN}{CRSR DN}12-0...";:GOSUB 1040
 527 PRINT
 528 GOSUB 660
 529 PRINT
 530 PRINT"DO YOU WISH TO SAVE THIS COLLEGES SCORES?"
 532 GET {Z}{Z}$:IF {Z}{Z}$="" THEN  532
 533 POKE53280,14:REM RESTORE SCREEN COLOR
 534 IFLEFT$({Z}{Z}$,1)="N"THEN23
 535 IFLEFT$({Z}{Z}$,1)="Y"THEN542
 536 IFLEFT$({Z}{Z}$,1)<>"Y"ORLEFT$({Z}{Z}$,1)<>"N"THEN5
     30
 542 GOSUB 1050
 570 GOTO23
 590 END
 592 PRINT:PRINT"THE NAME IS TOO LONG...SHORTEN TO NO "
 593 PRINT"MORE THAN 16 LETTERS AND SPACES. ":PRINT:GOTO
     41:RETURN
 600 IF B<=25 THEN X=5:GOSUB 1000
 610 IF B>25ANDB<46THEN X=4:GOSUB 1010
 620 IF B>=46ANDB<66THEN X=3:GOSUB 1020
 630 IF B>=66ANDB<76 THEN X=2:GOSUB 1030
 640 IF B>=76 THEN X=1   :GOSUB 1040
 650 RETURN
 660 IF TL<=35ANDTL>27 THEN GOSUB 1000
 665 IF TL<=27ANDTL>23 THEN GOSUB 1010
 670 IF TL<=23ANDTL>18 THEN GOSUB 1020
 675 IF TL<=18ANDTL>12 THEN GOSUB 1030
 680 IF TL<=12THEN GOSUB 1040
 685 RETURN
 700 IF DR<3 THEN W=5:GOSUB 1000
 710 IF DR>=3AND DR<7 THEN W=4:GOSUB1010
 720 IFDR>=7AND DR<19THEN W=3:GOSUB1020
 730 IFDR>=19AND DR<24THEN W=2:GOSUB1030
 740 IF DR>=24 THEN W=1:GOSUB 1040
 750 RETURN
 760 IF GR>89  THEN Y=5:GOSUB 1000
 770 IF GR<=89ANDGR>79THEN Y=4:GOSUB1010
 780 IF GR<=79ANDGR>64THEN Y=3:GOSUB1020
 790 IF GR<=64ANDGR>54THEN Y=2:GOSUB1030
 800 IF GR<55 THEN Y=1:GOSUB1040
 810 RETURN
 820 IF G>=90 THEN V=5:GOSUB 1000
 830 IF G>=63ANDG<90THEN V=4:GOSUB 1010
 840 IF G>=40ANDG<63 THEN V=3:GOSUB 1020
 850 IF G>=30ANDG<40 THEN V=2:GOSUB 1030
```

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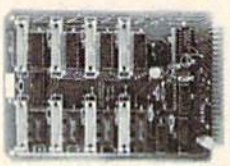

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Listing continued.

```
860 IF G<=29 THEN V=1 :GOSUB 1040
870 RETURN
880 IF SF<9  THEN U=5:GOSUB 1000
890 IF SF>=9ANDSF<12THEN U=4:GOSUB 1010
900 IF SF>=12ANDSF<15THENU=3:GOSUB 1020
910 IF SF>=15ANDSF<20THENU=2:GOSUB 1030
920 IF SF>=20THEN U=1:GOSUB 1040
930 RETURN
940 IF F$="++"THEN K=5:GOSUB 1000
942 IF F$="+"THEN K=4:GOSUB 1010
944 IF F$= "" THEN K=3:GOSUB 1020
946 IF F$="-"THEN K=2:GOSUB 1030
948 IF F$="--"THEN K=1
950 RETURN
960 IF PH>98 THEN DD=5:GOSUB 1000
962 IF PH<=98ANDPH>89THENDD=4:GOSUB1010
964 IF PH<=89ANDPH>79THENDD=3:GOSUB1020
966 IF PH<=79ANDPH>69THENDD=2:GOSUB1030
968 IF PH<=69 THEN DD=1:GOSUB 1040
970 RETURN
997 PRINT"{3 CRSR DNS}{CTRL 9}HIT ANY KEY TO CONTINUE{C
    TRL 0}"
998 GET{Z}$:IF{Z}$=""THEN998
999 RETURN
1000 PRINT"{CTRL 9}{CTRL 4}{21 SPACES}{CTRL 0}{COMD 7}"
    :POKE53280,3:RETURN
1010 PRINT"{CTRL 9}{COMD 6}{21 SPACES}{CTRL 0}{COMD 7}"
    :POKE53280,13:RETURN
1020 PRINT"{CTRL 9}{CTRL 8}{22 SPACES}{CTRL 0}{COMD 7}"
    :POKE53280,7:RETURN
1030 PRINT"{CTRL 9}{COMD 1}{22 SPACES}{CTRL 0}{COMD 7}"
    :POKE53280,8:RETURN
1040 PRINT"{CTRL 9}{CTRL 3}{21 SPACES}{CTRL 0}{COMD 7}"
    :POKE53280,2:RETURN
1050 OPEN 2,8,2,"0:COLLEGE SCORES,S,W"
1054 CLOSE 2
1056 OPEN 2,8,2,"0:COLLEGE SCORES,A"
1058 PRINT#2,A$;X;W;Y;V;U;K;DD;TL CHR$(13);
1060 CLOSE 2
1062 RETURN
1999 REM SORT ROUTINE
2000 REM COLLEGE SCORE SORT ROUTINE
2001 PRINT"{SHFT CLR}":REM CLEAR SCREEN
2002  RINT"WOULD YOU LIKE JUST SCHOOLS LISTED WITH SCOR
    ES OF 25 OR BETTER? {CTRL 9}A{CTRL 0}"
2003 PRINT:PRINT:PRINT:PRINTTAB(15)"--OR--":PRINT:PRINT
    :PRINT
2004 PRINTTAB(5)"WOULD YOU LIKE TO SPECIFY":PRINTTAB(12
    )"SCORE PARAMETERS  {CTRL 9}B{CTRL 0}"
2005 PRINT:PRINT:PRINT:PRINTTAB(15)"--OR--":PRINT:PRINT
    :PRINT
2006 PRINTTAB(5)"PRESS ANY OTHER KEY TO CONTINUE"
2012 GETN1$:IFN1$=""THEN2012
2013 EE=0:IFN1$="A" THENEE=2
2014 IF N1$="B"THENEE=3
2015 PRINT"{SHFT CLR}"
2017 PRINT:PRINT:PRINT:PRINT:PRINT"ONE MINUTE PLEASE, W
    HILE I SORT ALL THIS"
2020 IF N>=1THEN 2030
2021 OPEN 2,8,2,"0:COLLEGE SCORES,S,R"
2022 N=1
2023 INPUT#2,A$(N):PRINT"{COMD +}";
2024 N=N+1
2025 IF ST<>0 THEN CLOSE 2: GOTO 2030
2026 GOTO 2023
2030 N=N-1
2040 M=N
2050 M=INT(M/2):PRINT"{COMD B}";
2055 IF M=0 THEN 3080
2060 K=N-M:J=1
2070 I=J
2080 P=I+M
2090 IF RIGHT$(A$(I),3)>=RIGHT$(A$(P),3)THEN 3020
3000 T$=A$(I): A$(I)=A$(P): A$(P)=T$: I=I-M
3010 IFI>=1 THEN 2080
3020 J=J+1
3030 IF J<=K THEN 2070
3040 GOTO 2050
3080 PRINT"{SHFT CLR}"
3081 IF EE=2 THEN4080
3082 IF EE=3 THEN 4200
3085 FOR J=0TON
3090 PRINTA$(J)
3092 FOR WW=1 TO 1000:NEXT
4000 NEXT
4004 PRINT"{CTRL 9}HIT ANY KEY TO CONTINUE{CTRL 0}":PRI
    NT"OR F1 TO SEE LIST AGAIN"
4005 GETVV$:IFVV$=""THEN4005
4006 IF VV$=CHR$(133)THEN 3080
4010 RETURN
4080 PRINT"{SHFT CLR}"
4081 FOR J=0TON
4085 IF VAL(RIGHT$(A$(J),3))<25 THEN 4094
4090 PRINTA$(J)
4092 FOR WW=1 TO 1000:NEXT
4094 NEXT
4104 PRINT"{CTRL 9}HIT ANY KEY TO CONTINUE{CTRL 0}":PRI
    NT"OR F1 TO SEE LIST AGAIN"
4105 GETVV$:IFVV$=""THEN4105
4106 IF VV$=CHR$(133)THEN 4080
4110 RETURN
4200 PRINT"{SHFT CLR}"::PRINT"YOU WOULD LIKE THE SCHOOL
    S LISTED WITH "
```

Continued on p. 84.

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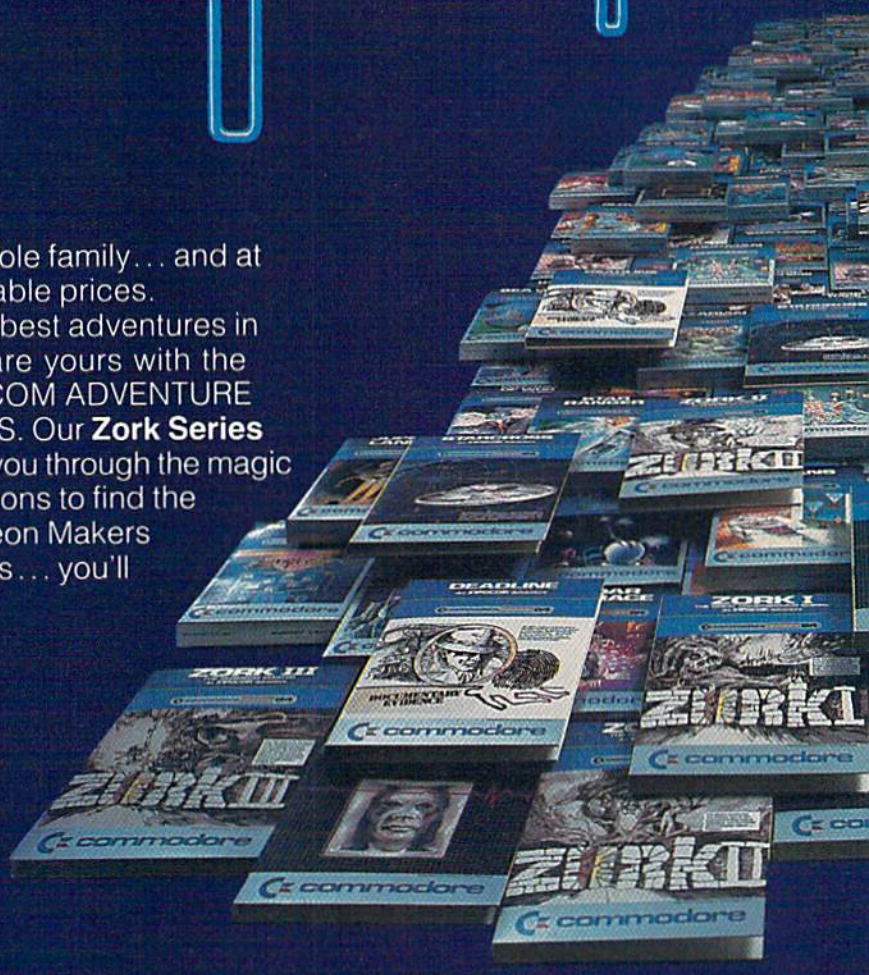

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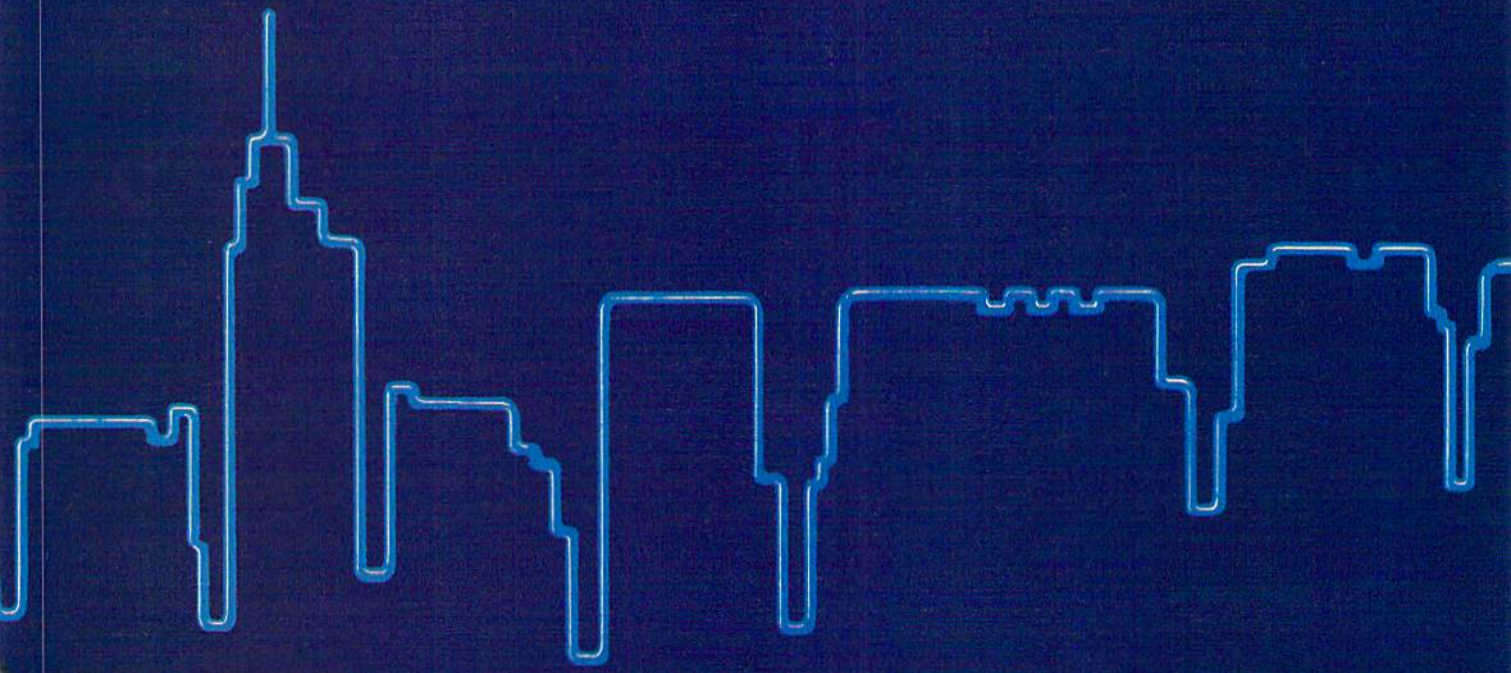

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Continued from p. 80.

```
4202'PRINT"SCORES BETWEEN{COMD P}{COMD P}{COMD P}{CRSR
     LF}?{COMD P}{COMD P}";
4204 PRINTTAB(20)"AND {COMD @}{COMD @}{CRSR LF}?{COMD @
     }{CRSR LF}?{COMD P}{COMD P}"
4206 INPUT S1,S2
4280 FOR J=0TON
4282 S3=VAL(RIGHT$(A$(J),3))
4284 IF S3<S1 OR S3>S2 THEN 4294
4290 PRINTA$(J)
4292 FOR WW=1 TO 1000:NEXT
4294 NEXT
4304 PRINT"{CTRL 9}HIT ANY KEY TO CONTINUE{CTRL 0}":PRI
     NT"OR F1 TO SEE LIST AGAIN"
4305 GETVV$:IFVV$=""THEN4305
4306 IF VV$=CHR$(133)THEN 4200
4310 RETURN
4900 PRINT"{SHFT CLR}"
4901 PRINT"WHICH VARIABLE WOULD YOU LIKE TO RANK? "
4905 PRINT"   (ENTER NUMBER OF CHOICE)":PRINT:PRINT
4910 PRINTTAB(5)"1  ACCEPTANCE RATE":PRINT
4920 PRINTTAB(5)"2  FRESHMAN DROPOUT RATE":PRINT
4930 PRINTTAB(5)"3  % GRADUATING FRESHMAN":PRINT
4949 PRINTTAB(5)"4  % GRAD/PROFESSIONAL SCHOOL":PRINT
4950 PRINTTAB(5)"5  STUDENT/FACULTY RATIO":PRINT
4969 PRINTTAB(5)"6  % FACULTY WITH PHD":PRINT
4970 PRINTTAB(5)"7  FACULTY SALARY":PRINT
4972 GET YY$:IF YY$="" THEN 4972
4974 IF YY$="1" THEN YY=17
4976 IF YY$="2"THEN YY=20
4978 IF YY$="3"THEN YY=23
4980 IF YY$="4"THEN YY=26
4982 IF YY$="5"THEN YY=29
4984 IF YY$="6"THEN YY=32
4986 IF YY$="7"THEN YY=34
5000 PRINT"{SHFT CLR}"
5001 PRINT:PRINT:PRINT:PRINT:PRINT"  ONE MINUTE PLEASE,
      WHILE I SORT THIS"
5002 IF N>=1THEN 5030
5004 OPEN 2,8,2,"0:COLLEGE SCORES,S,R"
5005 N=1
5010 INPUT#2,A$(N):PRINT"{COMD +}";
5012 N=N+1
5015 IF ST<>0 THEN CLOSE 2: GOTO 5030
5016 GOTO 5010
5030 N=N-1
5040 M=N
5050 M=INT(M/2):PRINT"{COMD +}";
5055 IF M=0 THEN 5140
5060 K=N-M:J=1
5070 I=J
5080 P=I+M
5090 IF MID$(A$(I),YY,3)>=MID$(A$(P),YY,3)THEN 5120
5100 T$=A$(I): A$(I)=A$(P): A$(P)=T$: I=I-M
5110 IFI>=1 THEN 5080
5120 J=J+1
5130 IF J<=K THEN 5070
5135 GOTO 5050
5140 PRINT"{SHFT CLR}":PRINT" WOULD YOU PREFER TO SEE J
     UST THOSE "
5141 PRINT" SCHOOLS THAT HAVE A SCORE OF 5 & 4? Y/N"
5142 GET T1$:IFT1$=""THEN 5142
5143 P1$=LEFT$(T1$,1):IF(P1$<>"Y")AND(P1$<>"N")THEN5140

5144 IF LEFT$(T1$,1)="Y"THEN 6010
5180 PRINT"{SHFT CLR}"
5185 FOR J=0TON
5190 PRINT LEFT$(A$(J),16),MID$(A$(J),YY,3)
5192 FOR WW=1 TO 1000:NEXT
6000 NEXT
6004 PRINT"{CTRL 9}HIT ANY KEY TO CONTINUE{CTRL 0}"
6005 GETVV$:IFVV$=""THEN6005
6008 RETURN
6010 PRINT"{SHFT CLR}"
6015 FOR J=0TON
6016 A1=VAL(MID$(A$(J),YY,3))
6017 IFA1<=3THEN 6040
6020 PRINT LEFT$(A$(J),16),A1
6030 FOR WW=1 TO 1000:NEXT
6040 NEXT
6044 PRINT"{CTRL 9}HIT ANY KEY TO CONTINUE{CTRL 0}"
6045 GETVV$:IFVV$=""THEN6045
6050 RETURN
7000 REM ALPHABET SORT
7001 PRINT"{SHFT CLR}":PRINT:PRINT:REM CLEAR SCREEN
7002 PRINTSPC(9)"TO SEE A SINGLE GROUP":PRINT"  ENTER A
     PPROPRIATE LETTER (A-G)"
7003 PRINT:PRINT:PRINT:PRINTSPC(15)"-OR-"
7004 PRINT:PRINT:PRINT:PRINT:PRINTSPC(7)"PRESS SPACE BA
     R TO CONTINUE"
7005 GET EE$:IFEE$=""THEN7005
7006 PRINT:PRINT:PRINT:PRINT:PRINT"ONE MINUTE PLEASE, W
     HILE I SORT ALL THIS"
7007 IF N>=1THEN 7030
7008 OPEN 2,8,2,"0:COLLEGE SCORES,S,R"
7009 N=1
7010 INPUT#2,A$(N):PRINT"{COMD +}";
7012 N=N+1
7015 IF ST<>0 THEN CLOSE 2: GOTO 7030
7016 GOTO 7010
7030 N=N-1
7040 M=N
7050 M=INT(M/2):PRINT"{COMD B}";
7055 IF M=0 THEN 7179
```

More →

Listing continued.

```
7060 K=N-M:J=1
7070 I=J
7080 P=I+M
7090 IF LEFT$(A$(I),3)<=LEFT$(A$(P),3)THEN 7120
7100 T$=A$(I): A$(I)=A$(P): A$(P)=T$: I=I-M
7110 IFI>=1 THEN 7080
7120 J=J+1
7130 IF J<=K THEN 7070
7140 GOTO 7050
7179 IF EE$<>CHR$(32)THEN 7380
7180 PRINT"{SHFT CLR}"
7185 FOR J=0TON
7190 PRINTA$(J)
7192 FOR WW=1 TO 1000:NEXT
7200 NEXT
7204 PRINT"{CTRL 9}HIT ANY KEY TO CONTINUE{CTRL 0}":PRI
     NT"OR F1 TO SEE LIST AGAIN"
7205 GETVV$:IFVV$=""THEN7205
7206 IF VV$=CHR$(133)THEN 7180
7210 RETURN
7380 PRINT"{SHFT CLR}"
7385 FOR J=0TON
7386 A5$=LEFT$(A$(J),1)
7388 IF A5$<>EE$THEN7400
7390 PRINTA$(J)
7392 FOR WW=1 TO 1000:NEXT
7400 NEXT
7404 PRINT"{CTRL 9}HIT ANY KEY TO CONTINUE{CTRL 0}":PRI
     NT"OR F1 TO SEE LIST AGAIN"
7405 GETVV$:IFVV$=""THEN7405
7406 IF VV$=CHR$(133)THEN 7380
7410 RETURN
```


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By Sharon Zardetto Aker

If you find the computer keyboard confusing, intimidating or simply inadequate for certain applications, you can choose one of three major alternate input devices: a mouse, a light pen or a graphics tablet.

While I've never tried a mouse, I can't accept this option as viable. First, I never have any clear space on my computer table where I could roll a mouse around. Second, it seems (although manufacturers claim otherwise) that it would be prone to mechanical difficulties, or at least be more susceptible than a device with no moving parts.

Third, and most important, when you move from one point to another on the screen, you have to roll through all the points in between. You can't just pick up the mouse from one corner of your desk, put it down on the other, and expect the screen cursor to move correctly as a result. So much for the mouse.

The light pen is a great idea—just touch the screen with it. With the right software, it's a good device, but you might get tired of constantly reaching up to the screen.

This leaves us, of course, with the graphics tablet. And what a nice thing to be left with! Using a stylus, or your finger, on a surface that can be flat on a table or comfortably tilted in your lap might be the ultimate in inputting.

While art is the outstanding application for tablets (if you want to program a picture, use the keyboard—if you want to *draw*, use a tablet), it is by no means the only one. With well-designed overlays and the right software, the tablet can change from a sketch pad to a piano keyboard, a dungeon map or a playing field.

Now that you're convinced that the tablet is a wonderful device, let's take a look at two that are available for both the Commodore 64 and the VIC-20: the KoalaPad, from Koala Technologies, and Chalkboard's PowerPad.

Pad Design

As far as overall dimensions, the KoalaPad measures a surprisingly small 6½ × 8 inches, with a 4¼- × 4¼-inch drawing surface. The PowerPad is much larger, measuring an overwhelming 19 × 21 inches, with a 12½- × 12½-inch drawing surface.

The drawing surfaces, too, are entirely different. PowerPad has a semi-glossy beige surface that feels like a piece of vinyl; it occasionally buckles away from its backing, a problem you can easily fix by tightening a few screws on the bottom of the pad. KoalaPad's firmly attached surface is a faintly grained black.

Both tablets are designed to take overlays for various programs. Koala-

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Pad's overlays have two tabs that fit into slots in the drawing area's frame; the overlays go in and out easily and remain in place with no slipping. PowerPad's overlays snap into place easily, but removing them requires care and patience. They are semi-transparent mylar sheets attached to thin plastic frames, but they are not too well attached—when I first removed one, *carefully*, from its case, it ripped away from half the frame.

At the top of the KoalaPad tablet are two buttons that perform functions such as pen up and down, confirming moves and choosing from the menu. PowerPad has no such buttons; its surface is large enough to allow for "command buttons," printed on the overlays, which register with the computer when touched.

PowerPad's unique design allows it to register more than one touch point at a time, so you can play chords in a music program instead of single notes. The KoalaPad can be substituted for a joystick in some programs.

Both pads come with a stylus, although your finger or any blunt instrument works almost as well. The steady pressure needed for the pad to read your input correctly is generally easier to apply when using the stylus.

I first thought the tablet would be perfect for young children, my own four-year-old, in particular. The KoalaPad, however, is too small for comfortable use by preschoolers in its drawing mode; children that young do not have enough fine-motor control to do much drawing in a four-inch area.

The PowerPad, on the other hand, is a little too big; my son, when sitting at a table, could barely reach the command buttons at the top of the pad. This didn't present too much of a problem, though, since he prefers kneeling when working at the Commodore 64.

Both pads are missing a minor detail that could be a major help: there is no place to keep the stylus. Some sort of snap-in slot to hold the pencil would be of great use; we spend a lot of time at my house *looking* for the stylus before we can *use* it.

Hooking Up

Both tablets connect to the computer through the joystick port. The PowerPad, however, requires that the computer be *unplugged* before connection. I am not electronically-oriented enough to understand why switching it off isn't sufficient; neither am I daring enough to experiment. PowerPad's programs are in convenient cartridge form.

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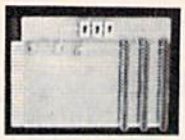

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The KoalaPad can be connected while the computer is already on, and its programs are on disk.

Electronic Art

The PowerPad has a drawing program, Leo's 'Lectric Paintbrush, that is good, but pales in comparison to the KoalaPad art program.

The overlay for Leo's 'Lectric Paintbrush has 23 command buttons across the top. Eight control color, while the others serve such functions as pen up and down, defining parameters for copy and move options, changing background color and loading and saving masterpieces.

The most obvious feature of this program is a poor one: you have to draw incredibly slow for all the contact points to register. The PowerPad scans its surface line by line and the scan rate is not adjusted to a normal drawing rate.

When you try to draw a line, it comes out as a series of separated dots unless you go so slowly as to inhibit any natural drawing movement. This can be especially frustrating when you use the Fill option and the color starts to leak out through a small opening in an otherwise-enclosed figure.

You choose colors with which to draw by touching one of the color buttons; to change the background color you press the background button before the color button. All the options are button-controlled; the buttons are clearly labeled and many have some graphic representation of their function, for pre-readers.

The KoalaPad drawing program, KoalaPainter, is fascinating and sophisticated. During the preparation of this review, I happened to see a television show on computer art, and KoalaPainter compared favorably with the routines on the show's featured mainframe computers.

KoalaPainter has an almost overwhelming pictorial menu screen that allows you to choose colors (solid or shaded with cross-hatching), "brushes" (the thickness of your drawing line, its angle and the number of points of contact) and other drawing options.

When choosing from the menu, touch your finger or stylus on the pad and an arrow will appear on the screen; you move to the menu selection and then press the button. To move from the menu to the drawing screen, touch the bottom of the drawing area and press a button.

You can draw free-hand, or make lines by defining their beginning and end points. There are options for circles and boxes; these shapes can be colored in later with the Fill command, or automatically upon drawing them.

KoalaPad
Koala Technologies Corp.
3100 Patrick Henry Drive
Santa Clara, CA 95050
408-986-8866
Price: $99.95

With the program's mirror option, you can draw in one quadrant and see the design appear simultaneously in the other three. You can take everything in your drawing that appears in one color and change it to another with the Exchange Color command.

While the mirror option is probably the most fun, "Zoom" is the most impressive. With Zoom, you can define a section of the screen on which you would like to work in greater detail. That section will be enlarged for you at the bottom of the screen, with the original still at the top. As you work on the enlarged section, you can see the changes on the true-size portion.

There are more options on KoalaPainter than can be adequately described in print; even seeing is barely believing. After booting it up, I have lost husband, child and even guests, for hours.

Other Software

At this time, the KoalaPad has only one title available (KoalaPainter comes with the pad). SpiderEater is a music education game that falls far short of its mark. While it's an interesting game designed to teach pitch—and does so somewhat effectively—it does nothing to further other aspects of music training, such as note recognition.

The labeling of notes on both the screen staff and the overlay keyboard is enough to make a music educator cringe (the two I know did). In addition, the limited keyboard makes free composition difficult. It is arranged to correspond to the staff, so it represents notes from E to F (an octave away); as a result, you can't play on the white keys and get anything that sounds right because you do not have the notes of a major scale available.

PowerPad has quite a few packages available for the Commodore 64. They each come in a large book-like case that contains a cartridge, an instruction

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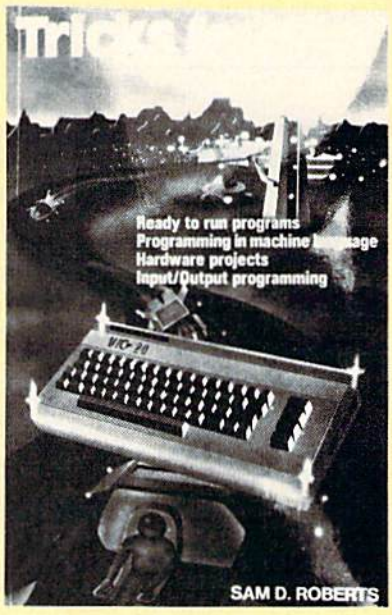

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manual and the overlay.

The program made available for review was MicroMaestro, which was quite impressive.

In MicroMaestro, the screen and the overlay match; each has a staff on the upper portion and a piano keyboard below. By pressing a key on the pad, you play the note and make it appear on-screen in its appropriate position on the staff, as well as on the key you pressed.

You can compose tunes and have them played back immediately, or save them to disk. You can even touch the correct button and your composition will be played back without any of the hesitations between notes that you might have made.

I can't understand, however, how such an excellent package could get to market with notes that have stems drawn on the wrong side of the note heads.

Programming

The input from both tablets is read in terms of the x,y coordinates of the pressure point, but that's about all the two have in common. PowerPad, for instance, reads 0,0 at the lower left, while the KoalaPad's coordinates begin at the upper left.

There are programming kits available for both tablets. PowerPad's kit comes with a grid overlay and a short tutorial booklet with sample programs on reading the tablet's coordinates, making command buttons and so on. The booklet includes the machine language routine needed for all the Basic routines; you do not need to know machine language to use it—all you have to do is type it in.

PowerPad
Chalkboard, Inc.
3772 Pleasantdale Road
Atlanta, GA 30340
800-241-3989
Price: $99

Since you cannot use the keyboard with the PowerPad plugged in, and you cannot plug it in without unplugging the computer, testing a program means you must write it, save it, turn the computer off, connect the pad and load the program...if you're lucky, you won't have a lot of debugging to do.

The KoalaPad's programmer's guide is a short book and a tutorial disk that contains sample routines for a number of applications, the most interesting being a sprite-design program. Since you can disconnect and reconnect the pad while the computer is on, developing a program is not quite as tedious as with the PowerPad.

Programming either pad is difficult because of the Commodore 64's lack of a sound/graphics language. The Basic routine you write for the pads takes the form of:

```
IF X=50 AND Y=100 THEN...
```

This tests for the x and y position being pressed. What follows the THEN, however, is up to you, and will take a lot of programming.

Summary

The graphics tablet is not a gimmick: it is a truly useful alternative to the keyboard. Both the tablets available for the Commodore machines are good, but the KoalaPad is the better of the two.

The PowerPad has a number of software packages that are immediately available, of generally good quality, and, for the most part, intended for children. Its size makes it especially good for children, but keep in mind that the overlays are flimsy and a child is unlikely to be able to handle them carefully enough to avoid damage. The drawing program will likely prove frustrating for children and adults alike, for reasons mentioned above.

The KoalaPad may fall short in software applications, although that is impossible to know on the basis of one review program. In the long run, however, it doesn't matter: The KoalaPad with the Painter program is worth the price even if you never use it for anything else.

Children under the age of about eight will find Painter difficult to work because of its size, and because of the large menu and necessity of changing back and forth from the menu to the drawing screen. For anyone else, however, it will become practically addictive.

I could write a little more on the topic, but I want to clear the word processing program out of my computer and load in KoalaPainter. R

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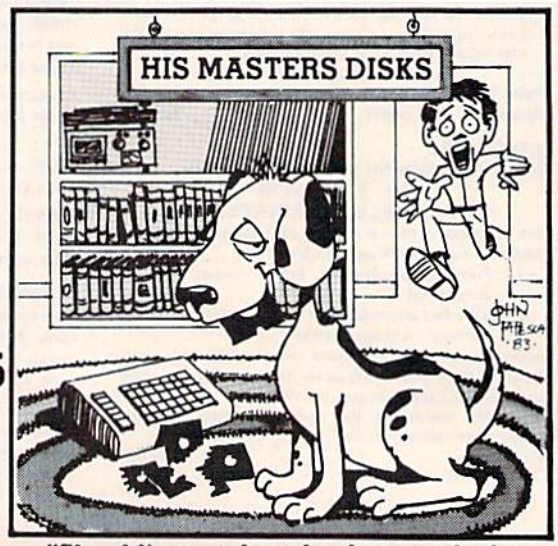

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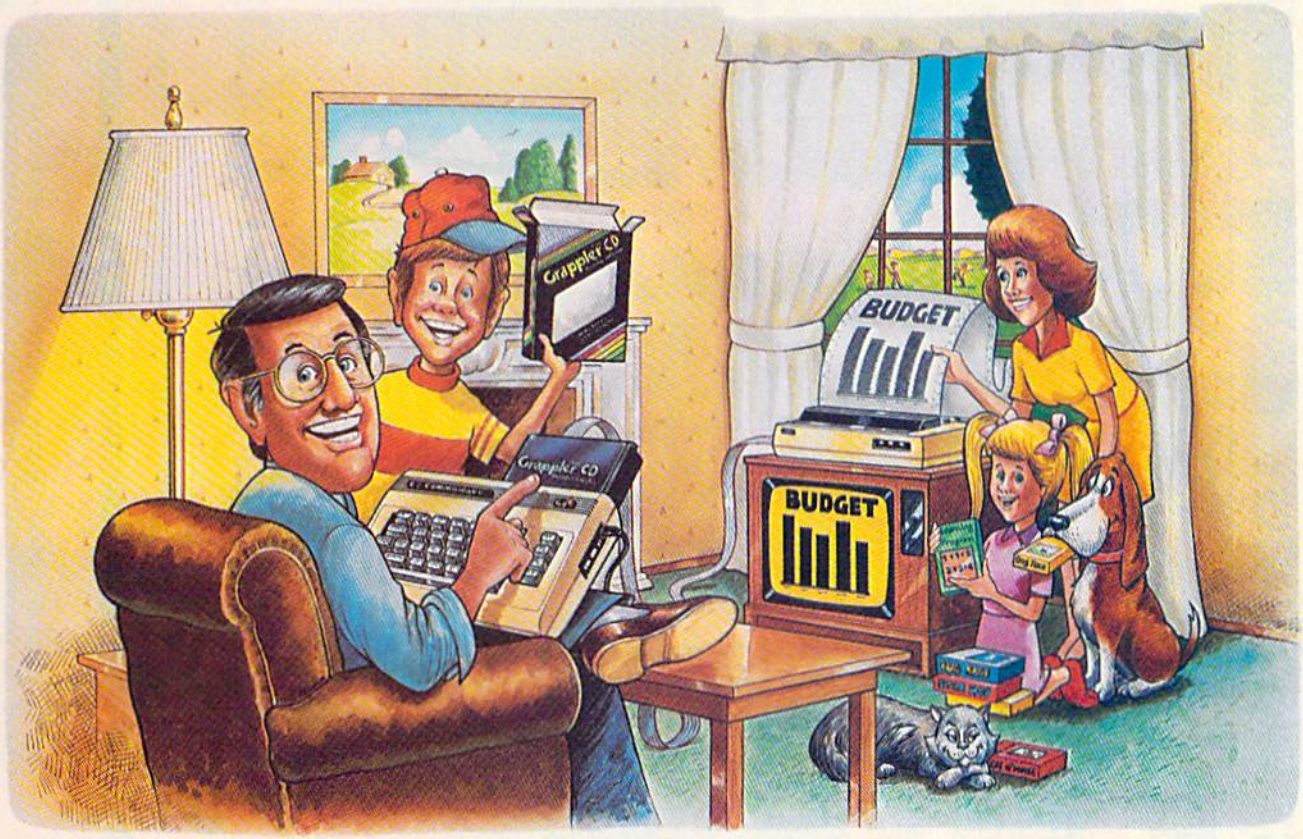

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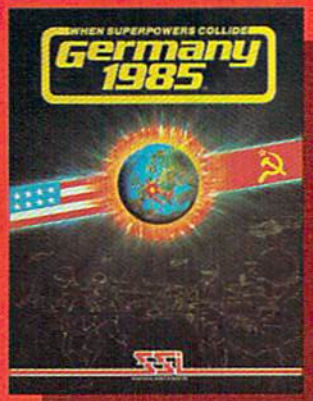

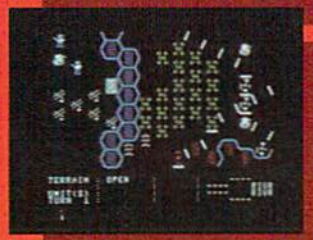

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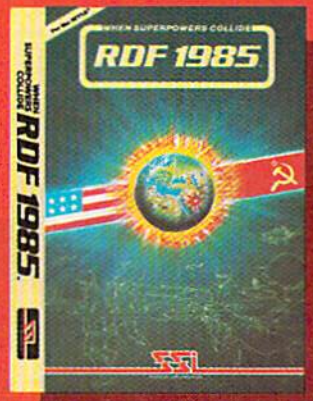

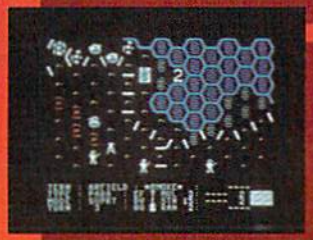

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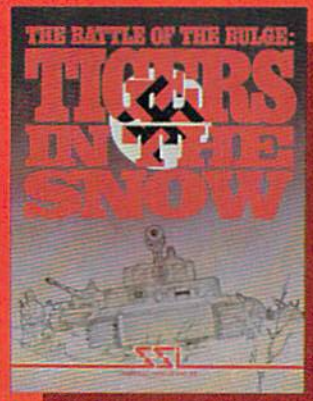

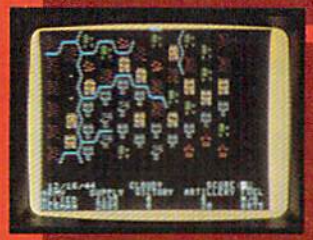

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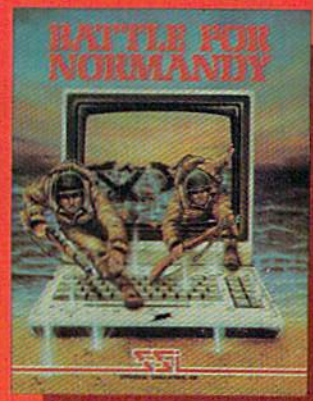

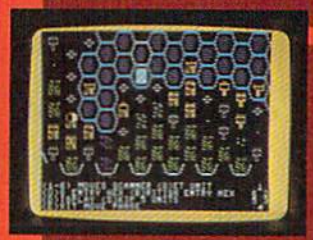

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Unveiling of the TED

Sneak Preview of Commodore's Next Million-Seller?

By Tom Benford

At press-time (late December 1983), *RUN* obtained the exclusive story on the release of a new addition to Commodore's personal computer line. Code-named TED, the Model 264 Personal Computer will take its place in the Commodore product line above the best-selling C-64.

The code name is derived from the Text Editing Device chip incorporated in this new micro's circuitry along with many other impressive features, including 64K RAM, a whopping 60K of which is available for Basic programming. Other outstanding features include:

- Full typewriter-style keyboard
- Optional built-in software
- Screen-window capability
- Help key
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- Over 75 Basic commands
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- Keyboard color controls
- 320×200 pixel screen resolution
- Reverse and flashing characters
- Two tone generators
- Built-in machine language monitor with 12 commands
- Different built-in software "flavors"
- 60K RAM available for Basic programming

The 264 is scheduled for release in early summer, but may be available in May, according to our sources. It is intended as an applications computer, and the built-in software "flavors" will include combinations of word processing, electronic spreadsheets, database and graphics. The 264 will also accept software on disk or cartridge for other applications. VIC-20 or C-64 software will not run on the TED without modification. The anticipated retail price will be in the $300-$400 range.

The TED chip is an innovative new approach, since it combines sound, graphics and the instruction set, all on the same chip. Essentially, all the added Basic commands now available on the C-64 Super Expander have been included in the 264's instruction set.

Of particular value for those interested in machine language programming is the inclusion of a machine language monitor with 12 instructions. Sprites are *not* included in the 264, and it contains only two tone generators, since it is intended primarily as an applications machine.

The help key provides prompts to aid the user in achieving the desired results. Voice support is another area being actively explored by Commodore, but whether or not the 264 will have this capability remains to be seen. Additional features and capabilities are still being engineered at press time and may be included before the machine is released for sale.

Mike Tomczyk, Commodore's director of market development and publications, tells us that the 264 is not intended to replace the VIC-20 or C-64, but to augment the company's product line. He's confident that the new approach of built-in software ("software on silicon") is a fertile new direction that computers will be taking in the future, and he heralds the 264 as a bold step in that area.

The 264 made its debut at the January Consumer Electronics Show in Las Vegas, and we'll continue to follow new developments and report additional features of the TED as the information becomes available. R

Address author correspondence to Tom Benford, 520 Havens Cove Road, Bricktown, NJ 08723.

LONG

Multiplication On the VIC-20

The VIC-20 doesn't always have the answer when it comes to really long multiplication. Put mathematical certainty back into your life and the life of your VIC with this precise program.

By Alex Lane

RUN It Right

Unexpanded VIC-20

Address author correspondence to Alex Lane, 1873 Bartram Road, Jacksonville, FL 32207.

Barney, one of the newer members of our local computing fraternity, called me early Saturday morning with an unusual sob story.

"Listen, Al," he said when I picked up the phone, "Lloyd came around yesterday and brought along that nephew of his, Lester."

"You mean the kid who's visiting from Colorado?" I asked.

"Yeah, that's right." His voice took on a dissatisfied tone. "What's more, the little tyke suckered me for a sawbuck, too."

"What happened?"

"Well, I was showing Lester my VIC-20 and let him play around with some games and stuff. Anyway, he finally said the VIC is only *so* good."

"In what way?" I asked.

"He said the VIC couldn't multiply two numbers and come up with an exact answer. In fact, he offered to bet ten bucks on it, and I took him up on it."

"That was unwise," I blurted, anticipating what was to follow.

"Really! He had the computer multiply two 10-digit numbers, and the result was displayed as one of those floating point numbers with an exponent on it." Barney sounded downright sheepish. "The kid was right, the answer wasn't exact."

Barney's story provoked my curiosity. How *could* you program the VIC to multiply long number strings? I could recall only one field in which such multiple-precision math was used: modern cryptography, where long (70-plus digit) prime numbers are used regularly in public-key encryption techniques.

Writing such a program sounded like a suitable challenge for a Saturday morning, and maybe, if Lloyd decided to drag his nephew over to my place, I could teach Lester about sucker bets. I rubbed my jaw, and sat down to work.

Not having the time to employ sophisticated methods, I decided to imitate multiplication by hand. The result is shown in Listing 1.

About the Program

You start by declaring three arrays: M1 for the first factor (multiplicand), M2 for the second factor (multiplier) and A for the product. The listing will allow the two numbers input to be up to 70 digits long, so the answer will never

64K for VIC 20
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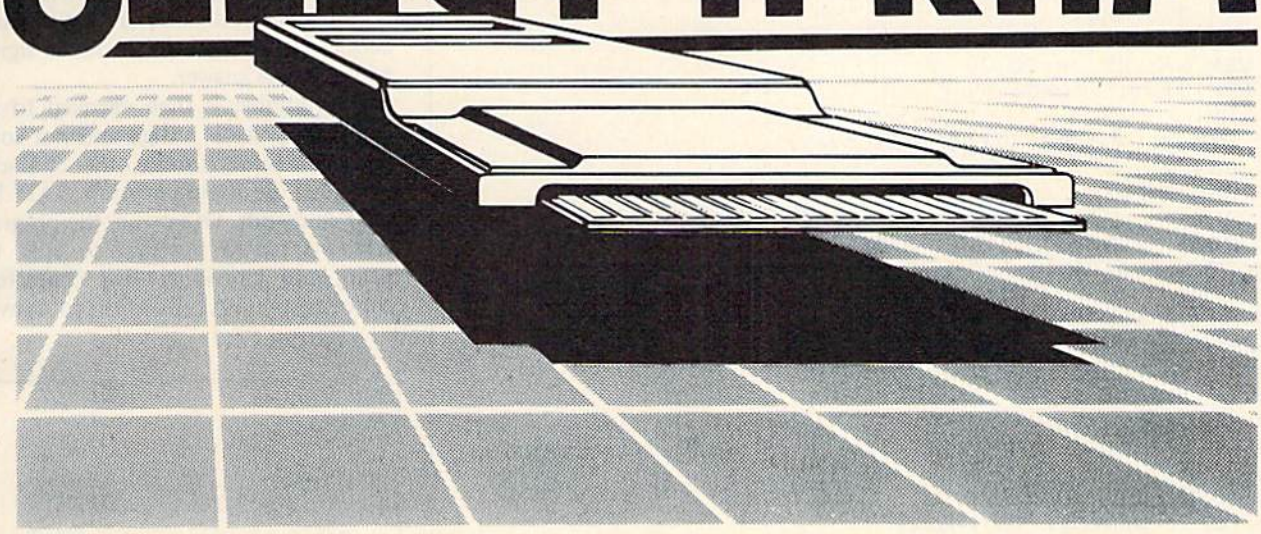

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```
10 REM LONGMULT.BAS
15 REM WRITTEN BY
20 REM ALEX LANE
25 REM 1873 BARTRAM RD
30 REM JACKSONVILLE
35 REM FL 32207
40 REM
45 REM WRITTEN FOR UN-
50 REM EXPANDED VIC-20
60 REM THIS PROGRAM
65 REM FINDS THE
70 REM PRODUCT OF TWO
75 REM NUMBERS,
80 REM EITHER OF WHICH
85 REM MAY BE UP TO 70
90 REM DIGITS LONG.
95 REM
100 DIM M1(70),M2(70),A(140)
105 REM
110 REM INPUT
115 REM
180 PRINT"{SHFT CLR}":INPUT"FIRST NUMBER";A$
183 IF LEFT$(A$,1)="-"THEN FL=FL+1:A$=RIGHT$(A$,LEN(A$)
    -1)
184 GOSUB 600
185 FOR I=LEN(A$) TO 1 STEP -1
190 M1(I)=VAL(MID$(A$,LEN(A$)-I+1,1))
195 NEXT I
200 INPUT"SECOND NUMBER";B$
203 IF LEFT$(B$,1)="-"THEN FL=FL+1:B$=RIGHT$(B$,LEN(B$)
    -1)
204 GOSUB 600
205 FOR I=LEN(B$) TO 1 STEP -1
210 M2(I)=VAL(MID$(B$,LEN(B$)-I+1,1))
215 NEXT I
217 IF A$="0" OR B$="0" THEN AN$="0":GOTO 550
220 REM
225 REM PROCESSING
230 REM
305 REM
310 FOR J=1 TO LEN(A$)
320 FOR I=1 TO LEN(B$)
330 F=I+J-1
340 A(F)=A(F)+M2(I)*M1(J)
350 IF A(F)>9 THEN A(F)=A(F)-10:A(F+1)=A(F+1)+1:GOTO 35
    0
360 NEXT I
370 NEXT J
380 REM
385 REM OUTPUT
390 REM
500 FOR I=140 TO 1 STEP -1
510 IF LEN(AN$)=0 AND A(I)=0 THEN GOTO 530
520 AN$=AN$+RIGHT$(STR$(A(I)),1)
530 NEXT I
540 IF FL=1 THEN AN$="-"+AN$
550 PRINT:PRINT"THE PRODUCT IS:"
560 PRINT AN$
565 END
600 REM
610 REM VERIFICATION
620 REM
630 IF F1=0 THEN C$=A$
640 IF F1=1 THEN C$=B$
650 FOR K=1 TO LEN(C$)
660 IF VAL(MID$(C$,K,1))=0 THEN IF MID$(C$,K,1)<>"0" TH
    EN PRINT"BAD INPUT":GOTO 565
670 NEXT K
680 F1=1
690 RETURN
```

Listing 1. Long Multiplication on the VIC-20 program.

be more than 140 places long.

Several special cases must be anticipated in the input: one or both numbers may be negative, one or both may be zero and a number may inadvertently contain a non-numeric character.

Immediately upon input of a number, the program checks to see if that number is negative. If it is, the minus sign is stripped off the number and variable FL is incremented by 1. Near the end of processing, in line 540, if FL is 1 (that is, if only one of the two numbers input is negative), a minus sign is added to the answer.

The number is then checked to see that each place is a digit and not some other character. If some other character is found, the program prints BAD INPUT and ends. Otherwise, the program uses the MID$ function to split the string into individual digit characters, performs the VAL function to convert the characters into numbers that can be manipulated mathematically and stores them into the M1 and M2 arrays.

The VIC-20 takes 20 minutes to multiply two 70-digit numbers with this program. About how long would it take you to do it by hand?

You must perform one final test before you can enter the main loop of the program—in line 217, check to see if one or both of the inputs is zero. If so, the main loop is bypassed and the answer, zero, is displayed directly.

Using the nested For...Next loops in lines 310-370, the arrays are processed in much the same way as if the numbers they represent were multiplied on paper, with the multiplicand (top number) over the multiplier (bottom number). The top number is sequentially multiplied, from the units place left, by the units, tens, hundreds and so on, place of the bottom number. If the result of any single multiplication is 10 or more, the tens place is carried to the next higher place of the answer.

If you were multiplying by hand,

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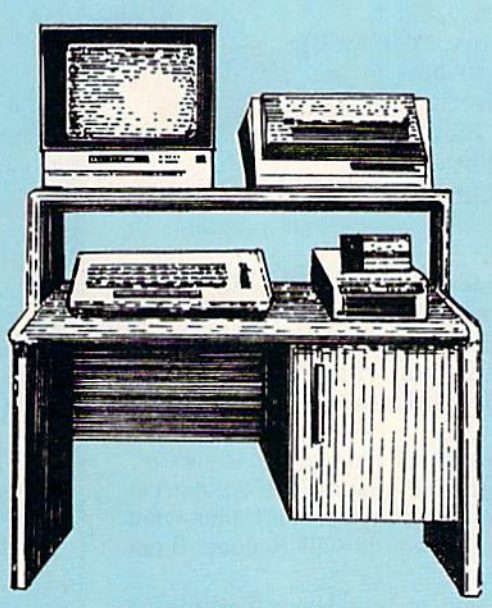

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once the top number had been multiplied by the leftmost place of the bottom number, you would add the results of each sequence of multiplications together; but the program does the addition as it goes along. Now the answer must be output.

Two problems must be faced in outputting the answer. First, it would be nice to avoid leading zeros (i.e., 2 times 2 should yield 4 and not 139 zeroes and a 4). Second, we'll be stringing together (concatenating) our answer from the individual elements of array A, where each element is a real number from 0 to 9. Converting an x-place real number into a string results in a string that's $x + 1$ places long; the leading character is either a blank (denoting plus) or a minus sign. Lines 510 and 520 take care of these problems.

The program does the job it was designed to do. Moderately short (5–7 digit) numbers are multiplied relatively quickly. However, the program takes longer to run as the factors become longer. When I ran the program multiplying two 70-place numbers (the extreme case), the VIC-20 churned for over 20 minutes before outputting an answer. A sample run is presented in Fig. 1.

Oh yeah, Lloyd came by my place later that day, albeit without Lester. The boy had spent his windfall the previous evening on pizza, ice cream and soda pop, and, well, wasn't in any condition to be anywhere except home in bed. R

```
FIRST NUMBER ? 1234567
89
SECOND NUMBER ? 111111
111

THE PRODUCT IS
13717420986282579


FIRST NUMBER ? 1234567
8912345678912345678912 3

SECOND NUMBER ? 987654
32109876543210987654321 0

THE PRODUCT IS
12193263124676116335 92
44016569919219508757 35
4050641167504830
```

Figure 1. Program output, 22-column format.

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Bringing Up Commodore

Introducing a Commodore machine into your household need not be an unsettling experience. This article presents, from the beginner's viewpoint, some valuable pointers about Commodore 64 and VIC-20 system setup and software organization. Try these suggestions, adapting them to meet your own needs.

By Karl T. Thurber, Jr.

Address author correspondence to Karl T. Thurber, Jr., 317 Poplar Drive, Millbrook, AL 36054.

The purchase of a home computer has changed many lives. It's an old story, repeated in hundreds of thousands of homes across the land. Evenings are no longer the same: your TV never gets used for watching TV anymore, meals are cold before you'll break away to eat them, and you never seem to get to read newspapers and magazines.

In fact, despite its potential as a timesaver, a personal computer can be the most time-consuming of any hobby. How the hours melt away!

To compound the unintended addiction, the first few months of computer ownership can be extremely demanding in terms of equipment familiarization, poring through not-too-helpful hardware manuals and studying often cryptic software instruction sheets. There's a lot of spinning of wheels involved in setting up a system.

Much of this wheel-spinning is really administrative in getting your system up and running: making all the right mechanical and electrical interconnections; deciding on disk booting and setup techniques; devising a convenient disk and filenaming system; cataloguing disks and tapes; selecting display colors; and getting started with software. The time you need to do all this is lengthened considerably if you've had little previous computer experience.

The purpose of this article is to help you short-circuit these many hours of cut and try. I'll describe a number of beginner-oriented tips and procedures for getting started with the VIC-20 and Commodore 64 computers. I'm assuming in what I write that you have a printer, a Datassette and disk drive, and a color monitor—for example, the VIC-1525 printer, the VIC-1541 disk drive, and the Comrex CR-6500 or Amdex Color I monitor. But the "cassette and TV set" hobbyist should find many useful ideas here, too.

I'll cover such matters as using the C-64 and VIC-20 with a shared set of peripherals, making display color selections for various types of programs, cataloguing a disk or tape collection, setting up disk-booting routines and techniques and beating the high cost of software.

Cataloguing: Tape vs. Disk

Most personal computer enthusiasts begin with a cassette drive. Growing sophistication along with more complex and demanding operations then usually lead to adding a disk drive, or sometimes two. Let's review some basic tape vs. disk storage considerations.

There are well-known limitations to using tape. The operations are slow and, with long programs, quite tedious, though the new "rabbit" devices and stringy floppies hold promise. Also, whether you read from a cassette data file or write to it, you must do so sequentially.

Further, you must be sure that the tape is positioned properly when reading or writing. Naturally, when reading from tape, the drive will search forward for a data file; but it can't find a file that was recorded at an earlier position on the tape.

Despite these disadvantages, tape-based systems are still popular because of their low cost, and many users are more comfortable with them than with disks. Also, some tape-oriented users compromise by using two cassette units for ease of duplication and tape handling.

If you stick with tape, there are a few housekeeping considerations to bear in mind. An especially important one is to note the tape-counter index number at the start and end of each program and to log this number on an index card each time the tape is written to. The

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card may be kept in a separate file cabinet, or cut down and placed inside the cassette box for easy visibility.

The newer Commodore Datassettes have a built-in tape index counter, but some of the older PETs with integral recorders (such as the PET 2001) have none. This makes keeping track of programs difficult. Some 2001 users have found it helpful to assign a sequential number to each program on each side of the tape as an on-screen aid in searching for a particular program. (C-10 cassettes are a good choice, as they are not so long as to require unreasonable search times.)

Another tip: leave some space between programs to allow for modifications that might not otherwise fit in before the next program begins. Be sure, however, that the space between the programs is truly blank, with no remnants of a previous program.

Group similar programs together on labeled cassettes to avoid needless jumping from cassette to cassette when going from, say, one business program to another. There's enough time lost with tape operations without added confusion!

An open, flat storage box that will hold about 30 cassettes makes for easy and fast tape retrieval. Use a paste-on label on the edge of each box so that the contents of each tape are readily visible. You should supplement the tape box annotations with a separate written tape log, an essential for maintaining a systematic file.

The log should include the name or other description of the file, the version number (if applicable), the date the file was created, the tape name or number on which the file is located, the tape-counter index number showing where the file begins and the next available index number. Include other information that suits your particular needs.

There is little you can do to fully automate tape cataloguing. You can use an indexing and filing program, but since it takes a good deal of time to maintain, it's usually easier to locate the desired cassette manually, relying on paper records.

However, if you're interested in various tape-aid programs, several are available in the Public Domain and Toronto PET Users Group (TPUG) collections. The TPUG even has a program to print out a form-fitting cassette-box label and program listing, should such a capability be useful to you. (More on these software sources in a subsequent installment.)

In addition to the utilities available from the two sources mentioned, a tape program developed for the PET by Robert W. Baker (see Find That Program! in the May 1981 issue of *Microcomputing*) is helpful for keeping tabs on a tape program collection. Baker's program finder is designed to provide a convenient method of locating specific programs or groups of programs within a large library.

Various flexible options are available for copying or editing data files and for finding specific types of programs (using sets of user-designed "qualifiers"), thus providing an easy means of maintaining a large software collection. However, this PET program supports Commodore 2022 and 2023 printers, and so might require modification to work with the C-64 or VIC-20 and the 1525 or 1526 printer.

Unlike diamonds, disks are not forever, so you'd be smart to make backup copies of irreplaceable programs.

Disk Advantages

As your tape programs become longer and waiting times increase, you may well decide that a disk drive is almost a necessity. Conversion to disk opens up many new program options that were impractical or impossible with the single cassette drive.

Also, if one disk drive is good, two are much better—and the new 1541s from Commodore are realistically priced, so that adding a second drive is not prohibitively expensive. Adding the second drive opens up a new vista of convenient backup for important disks and programs, exchange with other users, duplication of machine language programs and enhanced cataloguing possibilities.

With disk, you can access data quickly in comparison with cassette file access times. The advantages and intricacies are many, but one of the most important is that the disk has a directory that contains the name and ID assigned to the disk, together with the names of all files and related data.

The directory can be reviewed when a disk is inserted in the drive to ascertain not only what files are on the disk, but also how many blocks each file uses, the type of file and the total blocks that are free for storing additional files.

To make effective use of disks, you need to develop an organized system for cataloguing and storing them. Once you've developed a healthy collection, simply tossing them loose into a cardboard box doesn't work any more. A software organization system need not be complex; rather, it should be simple, and set up in a manner most useful to you.

There are various ways to set up disk files for quick and orderly retrieval, so it's a good idea to look at how you organize paper files and draw parallels to them. With just a few disks on hand, you may be able just to label the disks themselves and the disk boxes along subject, date, alphabetical or functional lines. With more disks, a separate paper record and cross-index is useful, and when the number of disks on hand is truly large, your computer may be needed to "keep track of itself."

The disks themselves should not be stacked haphazardly or left lying about where they can accumulate dust and grime. While an ordinary plastic or metal letter sorting unit is handy for storing often-used disks, flip-top disk storage boxes or binders with pocketed plastic pages offer far greater protection from common hazards.

Labeling and Backups

An important consideration is the header information on individual disks. Header labeling and numbering should be thought through early-on, since once the header information is on the disk and programs are stored on it, it's inconvenient to change this information.

The disk name can be anything up to 16 characters long, while the disk ID is any two alphanumeric characters. The disk name should describe what is on the disk as accurately as it can within the 16 available characters. For example, to label a disk as "VIC-20 General" is not as useful as naming the disk "VIC Adult Games" or "C-64 Utilities."

I've found it useful to create a new disk whenever a program in a new classification is developed, rather than merely adding such a program to an existing disk. This saves copying tedium later on, when other programs of like classification are written and the out-of-place programs have to be transferred to other disks.

The disk ID can be a chronological sequence number, or you can assign an

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alphanumeric code, such as "G1" for the first game disk in your collection. The disk ID you assign should be unique to avoid confusion if you keep a computer file keyed on disk ID.

Note that commercial software disks you purchase may use disk names and IDs that are at variance with the system you've set up, thereby causing duplication you can't help.

Commercial file-manager software can allow you to design your own custom filing or index system to suit your disk cataloguing needs. Eventually, you'll almost certainly need such a system to manage your collection efficiently.

Once you've decided upon a system of organizing and managing your disks, you should also make duplicate copies, at least backups of your most important software. Admittedly, I do not back up every piece of new software or file that I create, since most of my files are not critical.

However, recognizing that disks, unlike diamonds, are not forever, I do make backup copies of the more important, irreplaceable or expensive programs and files. I keep these in a place separate from the working copies. How critical the data is, how often it changes and how significant or costly its loss would be are the factors determining whether or not to back up files.

A further refinement of computer file index systems is a disk library system that reads the Commodore DOS and allows much more sophisticated cataloguing of a disk collection. I use a C-64 modification of Baker's Disk Master, which originally appeared for the PET (see the June 1982 issue of *Microcomputing*). It requires two VIC-1541 disk drives.

This sophisticated program automatically reads the directory of any disk placed in one drive, and writes a condensed directory data file on the master directory disk on the other drive. The program also maintains a cross-reference file to keep track of the relationships between disk IDs and disk names—hence the need to assign them carefully and logically from the start.

The Disk Master program also provides several utility functions that locate specific files; display individual disk directories; list disk names and IDs currently in use; find a suitable disk "open" with available blocks for adding programs; and print various hard-copy records.

Disk Booting

On each disk I create, and many of those purchased commercially that have available room, I write a number of convenient facilitating utilities. I always include the Commodore DOS support (Wedge) programs that are supplied with the VIC-1541 drive for either the Commodore 64 (in two parts, the Wedge and the DOS 5.1) or the VIC-20, as appropriate.

For convenient single-keystroke loading of the Wedges (which vastly simplify disk operations) I have renamed the Wedges to "!!" for the C-64 and "%" for the VIC-20. Actually, I have two versions of the C-64 Wedge: one to bring up the screen in a gray-on-gray presentation for business programs (designated as filename "!!"), and another to bring up the screen with a colored border for most general purpose work and games (designated as filename "!").

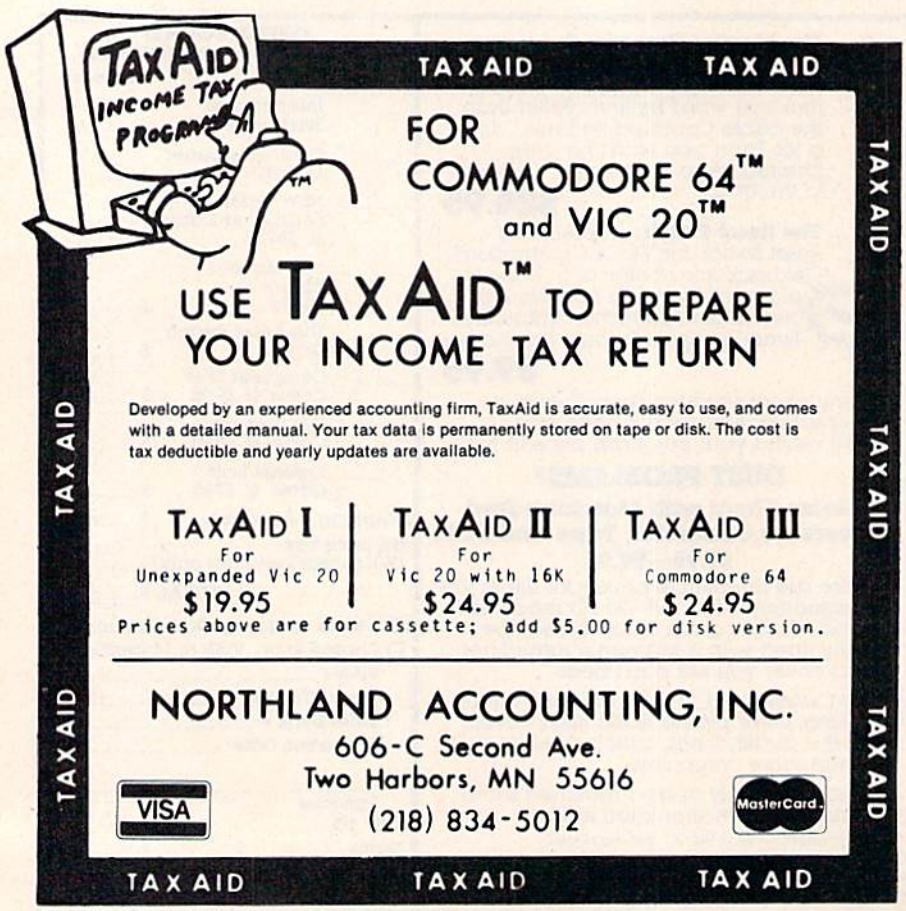
On most game disks, I also write an Autoloader program, either in a VIC-20 or C-64 version. The program appeared in *Compute!* for March 1983 (Automatic Commodore Program Selector, by Steven A. Smith). This fully automatic program generates menus to load and run desired programs under simple, single-keystroke control.

You can insert a disk and load this program, and it will in turn find out what programs are contained on the disk and build a menu around them. It's a little slow, since the program must read the disk directory each time it runs, but it's nice to use, since a single keystroke loads the desired program.

Another very useful program, and one which I place on practically every disk, is John Anderson's Baby Driver menu program for the VIC-1540 disk drive, which he described in the 1983 *Creative Computing Buyer's Guide to Personal Computers, Peripherals and Electronic Games*. This program was contained in his VIC-1540 review, What a Difference a Drive Makes, on p. 128 of that guide, and was subsequently reprinted in the April 1983 issue of *Creative Computing*.

The inclusion of this program on an active disk nicely complements the Wedges, and it also works well with the 1541 drive and both the VIC-20 and C-64. Its menu-based command system eliminates the need for the use of most of the cryptic command codes required by the Commodore drives, and the program allows for a number of disk command functions by single keystroke.

The menu functions include calling



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up a disk directory; formatting a disk; initializing; copying, renaming, erasing, and validating files; and reading of the error channel of the disk. The program will even write a copy of itself to another disk (a highly useful function).

While there is some duplication of functions between the Baby Driver and the Commodore Wedge/DOS support programs, I find it very easy to use, and it can be used whether or not the Wedge programs have been loaded. Some users may even prefer the Baby Driver over the still-cryptic Wedge by virtue of its simple, menu-driven operation.

Since I place the Wedge/DOS support, Menu and Autoloader programs on almost every disk, I find it useful to create a "boot disk" with all the right facilitating routines on it. From it, the desired utilities can be "cloned" onto each virgin disk as needed. Since the Wedges and DOS Support programs are partially in machine language, I use a second disk drive, copying directly from one drive to another.

Looking at the boot disk's directory (Listing 1), there are four sets of programs on the disk. The first set is the Commodore 64 Wedge, DOS, Menu and Autoloader programs previously described. These are brought up in gray-on-gray for business-type programs.

This set of programs is followed by a "spacer," which is simply an empty program (just a filename) that is used as a "marker" when executing the copying programs. The next set of programs contained on the boot disk is the VIC-20 Wedge, Menu and Autoloader programs (not in that order), followed by another spacer.

Next are the two utility programs required to set up the two drives for copying. These are the disk address change program (which I call 7 DISK AC 64) and Jim Butterfield's copy program (8 COPY/ALL).

Following a third spacer is another set of C-64 utilities, which is the same as the first set on the disk, except that these programs provide a gray color text, whitish background and blue border, a matter of personal taste for many non-business programs. Listing 2 shows program listings of the color-modified Wedge loaders.

For convenience, as mentioned earlier, I use single-keystroke program names in lieu of the full Wedge names. Also, many of the most used programs are preceded by a number, so that the program can quickly be loaded by means of the pattern-matching technique using the * character as part of the filename, as described in the VIC-1541 user's manual.

For example, I load the disk address change program merely by typing in LOAD "7*", 8; or, if the Wedge is in use, simply by typing "/7*". As can be seen from a glance at the boot disk's directory, I use several such numbers as the first digits of filenames, and have, in fact, reserved the digits 1 through 9 for just such timesaving purposes. Doing so is a real convenience—just be careful to jot down what the shorthand program name really means, and don't begin any regular program filenames with these numbers! R

```
0 "BOOT DISK         " 08 2A
1     "!!"                PRG
4     "DOS 5.1"           PRG
10    "MENU 64"           PRG
6     "AUTOLOAD 64"       PRG
1     "SPACER I"          PRG
10    "2 MENU"            PRG
6     "6 AUTOLOAD"        PRG
4     "%"                 PRG
1     "SPACER II"         PRG
5     "7 DISK AC 64"      PRG
11    "8 COPY/ALL"        PRG
1     "SPACER III"        PRG
1     "!"                 PRG
4     "DOS 5.1C"          PRG
10    "4 MENU 64C"        PRG
6     "5 AUTOLOAD64C"     PRG
584 BLOCKS FREE
```

Listing 1. The boot disk directory. DOS 5.1C is the same as DOS 5.1. I renamed the DOS program for convenience in setting up the boot disk. DOS 5.1 is loaded by "!!", while DOS 5.1C is loaded by "!".

a)
```
5 POKE 53280,0:POKE 53281,11:PRINT
   "(SHFT CLR)(COMD 5)"
10 IF A=0 THEN A=1:LOAD"DOS 5.1",8,1
15 PRINT"(SHFT CLR)"
20 IF A=1 THEN SYS 12*4096+12*256
30 NEW
```

b)
```
5 POKE 53280,6:POKE 53281,12:PRINT
   "(SHFT CLR)(COMD 4)"
10 IF A=0 THEN A=1:LOAD"DOS 5.1C",8,1
15 PRINT"(SHFT CLR)"
20 IF A=1 THEN SYS 12*4096+12*256
30 NEW
```

Listing 2. The color-modified Wedge loaders. Experiment with the Poke and Print statements in line 5 to determine which combinations produce the best results on your video monitor or TV set. These combinations may be different from the ones I chose.

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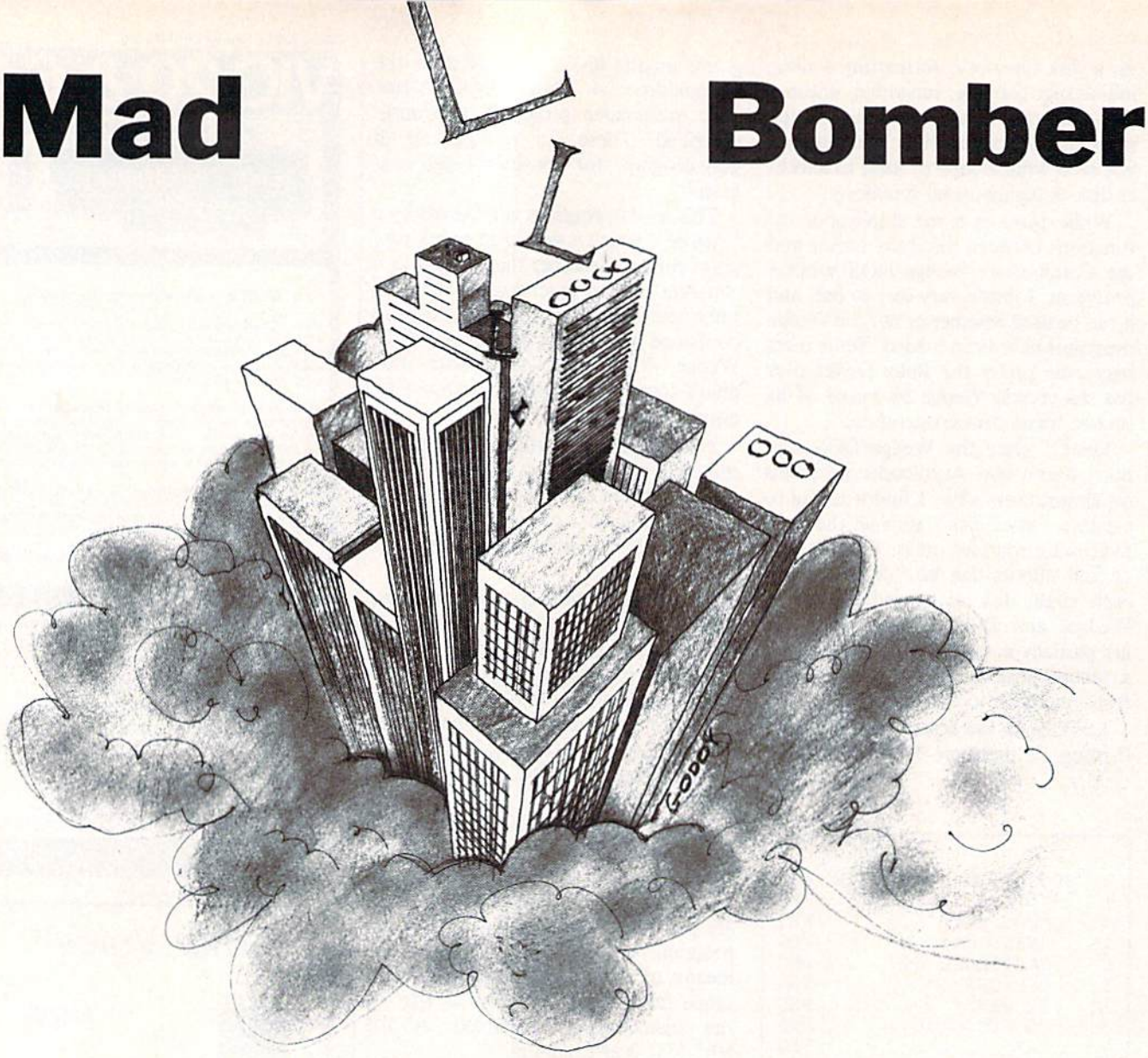
Mad L Bomber



A city is being plagued by random letter bombs; its inhabitants fear for their lives. Where is Dirty Harry when you need him? Only your quick thinking and familiarity with the keyboard can save the city.

By Gary V. Fields

RUN It Right
Commodore 64

Address author correspondence to Gary V. Fields, 86 Lanvale Ave., Asheville, NC 28806.

Which is more important—learning on your home computer or having fun with it? That probably depends on whether you're a child or the child's parent. But Mad L Bomber is both fun and educational.

Play this game and you might learn to type, or at least become familiar with the keyboard. And as anyone in business knows, keyboards are everywhere.

The Mad L Bomber attacks Anycity, U.S.A., with mean letter bombs. He can attack very fast if you want, or very slowly. Your skill with the keyboard should determine the speed.

The quiet calm of the title screen is shattered by a siren and attack L bombs (letter bombs). The sound on the program is captivating, and the better your monitor's or tv's speaker, the better the sound.

You are asked to pick a speed, and the fun begins. A city in low-lying fog is displayed. Suddenly the screen alerts you with a flashing "Code Red" alarm.

Out of the clouds comes the villain himself. But don't pay him too much attention—he's just trying to distract you so his randomly dropped bomb can make it to ground zero.

Sometimes the letter bomb comes from beneath Mad L Bomber, but usually it drops from another part of the sky. You must recognize the letter and press the same letter on the keyboard before the bomb twists, turns and explodes on the city below.

If you are fast and correct, the bomb will self-destruct—tumble and explode. Then, the Mad L Bomber will beat a quick retreat into the clouds above.

But don't go away. He'll be back for a total of 21 bomb runs or until he wins, whichever comes first.

If you match the Mad L Bomber letter for letter, you'll win, and Anycity, U.S.A., will thank you with hearty applause. The program then gives you a chance to choose a speed and begin again.

3—Goes to title screen and siren.
4—Sets up for sprite. BX and BY are the sprite location variables.
5—Sets sound variables and Pokes Mad L Bomber yellow.
6—Requests speed and Pokes Bomber into upper left corner of screen.
7–15—Input the speed to use on bombs.
16—MC is the variable that counts bombs.
20–22—Poke the screen black and check to see if game is half over—MC>20.
23–25—This is the halfway-through subroutine. If MC>20, then program goes here.
30—TT keeps track of where bomb is on the screen.
31–36—Flash the Code Red warning with beeping sound.
37—Double checks input in main loop will begin (tab=N).
40—N chooses where bombs will start on screen (tab=N).
50—Pokes screen black and moves cursor to home position (CHR$(19)).
70–82—Define city and sky.
94—CR limits rising fog and clouds from going above screen.
95–98—Randomly Poke fog or clouds on screen.
100—LE chooses which letter will be a bomb.
110—Makes sure bomb is a letter and not a number or graphics symbol.
120—GETK$ starts looking for keyboard response to falling L bomb.
130—If proper response was made, this calls up explosion in routine 155–250.
155–250—Falling letter tumbles, explodes, and Mad Bomber heads for cover.
170–178—Make bomb appear to explode.
200—Pokes all the sound off.
250—Adds to MC counter. Pokes Sprite off and returns for another bomb.
300–350—The falling bomb sound.
310—Converts N (tab value) to value with an angle for dropping bomb's twist.
311–312—Keep the bomb within the screen's borders.
360—Detects when bomb touches city.
370—Erases each letter and leaves a red trail where it had been.
800–808—Make screen and city appear to explode.
810–820—Last screen.
820—Goes to hear the siren again.
830–854—Ask if player wants to continue or quit.
1050–1054—Explosion sound.
2000–2028—Title Screen.
2029—Reads Sprite data lines and Pokes it into the proper memory location.
2030–2080—Siren sound.
4000–4070—Winner routine.
6000–6003—Data lines which define Mad L Bomber Sprite.

Table. Line by line explanation of Mad L Bomber program.

But if you fail, the city explodes, you are notified of how many letter bombs you stopped, and you are given the chance to play again.

By the Way

Also note that an early morning fog rises during the first half of the attack. After the tenth bomb run by the Mad L Bomber, you are given a short rest. When the attack continues, the fog is gone, but now an ever-thickening cloud cover makes early recognition harder and success tougher. After each attack, the fog or clouds thicken and rise.

I will be glad to copy Mad L Bomber for anyone who doesn't want to type in the listing. Just send me a cassette or formatted disk along with a self-addressed stamped mailer and $3. R

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Listing of Mad L Bomber program.

```
1 REM MAD L BOMBER
3 GOSUB 2005
4 V=53248:POKEV+21,0:POKE2042,13:BX=80:BY=30
5 SV=54296:SW=54276:SA=54277:SH=54273:SL=54272:JUMP=0:P
    OKEV+41,7
6 PRINT"SPEED PLEASE":POKEV+4,BX:POKEV+5,BY
7 PRINT:PRINT"SUPERFAST-1":PRINT"FAST-2":PRINT"MEDIUM-3
    ":PRINT"SLOW-4"
8 INPUT"OR SUPER SLOW-5";XP
9 IFXP=1THENSP=0
10 IFXP=2THENSP=75
11 IFXP=3THENSP=150
12 IFXP=4THENSP=300
13 IFXP=5THENSP=600
14 IFXP>5THENPRINTCHR$(147):GOTO6
15 IFXP<1THENPRINTCHR$(147):GOTO6
16 MC=0:PRINTCHR$(147)
20 IFMC>20THEN4010
21 IFMC<>10GOTO30
22 IFMC=10THENFORX=1TO4:POKE53281,1:POKE53280,1:POKE532
    81,0:POKE53280,0:NEXTX
23 PRINTCHR$(147):FORX=1TO7:PRINT:NEXTX
24 PRINTCHR$(18)"  VERY GOOD - YOU'RE HALF WAY THROUGH"
    :PRINTCHR$(19):JUMP=0
25 GOSUB2031
30 TT=1 :X=0
31 FORLP=0TO2
32 POKESV,15:POKESW,33:POKESA,0:POKESH,45:POKESL,0
33 PRINTCHR$(19)"  CODE RED - MAD L BOMBER APPROACHING
     ":FORLO=1TO100:NEXTLO
34 PRINTCHR$(19)CHR$(18)" CODE RED - MAD L BOMBER APPRO
    ACHING  "
35 POKESV,0:POKESW,0:POKESA,0:POKESH,0:POKESL,0:POKEV+2
    1,4
36 FORLO=1TO40:NEXTLO:NEXT LP
37 IFK$=CHR$(X)THEN40
40 N=INT(RND(1)*38)+1
41 IFJUMP>0THENGOTO82
42 JUMP=1
50 POKE53281,0:POKE53280,0:PRINTCHR$(5);CHR$(19)
70 FOR X=0TO39:POKE1944+X,120:POKE56216+X,7:NEXTX
75 FORX=0TO3:LD=INT(RND(1)*30)+1:POKE1904+LD,102:POKE56
    176+LD,13
77 POKE1864+LD,92:POKE56136+LD,13:NEXTX
80 FORX=0TO5:LD=INT(RND(1)*35)+1:POKE1904+LD,102:POKE56
    176+LD,1:NEXTX
82 FORX=0TO39:POKE1024+X,42:POKE55296+X,12:NEXTX
94 CR=CR-40:IFCR<-800THENCR=-800
95 FORX=0TO24:LD=INT(RND(1)*35)+1
96 POKE1864+LD+CR,42:POKE56136+LD+CR,1:NEXT X
97 FORX=0TO4:LD=INT(RND(1)*35)+1
98 POKE1144+LD,42:POKE55416+LD,1:NEXT X
100 LE=INT(RND(64)*90)+1
110 IFLE<65ORLE>90GOTO100
120 GETK$:IFK$=""THEN302
130 IFK$=CHR$(LE)THEN155
140 GOTO302
155 POKESV,15:POKESW,133:POKESA,0:POKESH,0:POKESL,130
156 FOR FRY=1TO2
157 BX=BX+4:BY=BY-8:POKEV+4,BX:POKEV+5,BY
170 PRINT CHR$(13)CHR$(145)CHR$(145)TAB(N);:PRINT"/"
172 PRINT CHR$(13)CHR$(145)CHR$(145)TAB(N);:PRINTCHR$(L
    E):BX=BX+4:BY=BY-8
173 PRINT CHR$(13)CHR$(145)CHR$(145)TAB(N);:PRINT"-":PO
    KEV+4,BX:POKEV+5,BY
174 PRINT CHR$(13)CHR$(145)CHR$(145)TAB(N);:PRINT"*":BX
    =BX+4:BY=BY-8
175 PRINT CHR$(13)CHR$(145)CHR$(145)TAB(N);:PRINTCHR$(2
    8)".":POKEV+4,BX
176 PRINT CHR$(13)CHR$(145)CHR$(145)TAB(N);:PRINTCHR$(L
    E):POKEV+5,BY
178 PRINT CHR$(13)CHR$(145)CHR$(145)TAB(N);:PRINT"+":PR
    INTCHR$(5)
179 NEXTFRY
180 POKESV,15:POKESW,129:POKESA,15:POKESH,40:POKESL,200

182 POKEV+21,0:FORPL=1TO100:NEXTPL
185 POKESV,0:POKESW,0:POKESA,0:POKESH,0:POKESL,0
187 POKESV,15:POKESW,129:POKESA,15:POKESH,40:POKESL,200

188 POKESV,9:FORPL=1TO20:NEXTPL:POKESV,6:FORPL=1TO20:NE
    XTPL:POKESV,0
189 POKESW,0:POKESA,0:POKESH,0:POKESL,0
190 POKESV,15:POKESW,129:POKESA,15:POKESH,40:POKESL,200

191 FORPL=1TO350:NEXTPL
195 POKEV+21,0:POKEV+5,24:POKEV+4,60
200 POKESV,0:POKESW,0:POKESA,0:POKESH,0:POKESL,0
250 MC=MC+1:PRINTCHR$(19):BX=60:BY=60:POKEV+21,0:GOTO20

302 POKESV,15:POKESW,13:POKESA,240:POKESH,44:POKESL,0
304 POKESV,0:POKESW,0:POKESA,0:POKESH,0:POKESL,0
306 TW=INT(RND(1)*2)
308 IFTW=0THENBD=1
309 IFTW=1THENBD=-1
310 N=N+BD
311 IFN<3THENN=3
312 IFN>37THENN=37
325 PRINTCHR$(13)CHR$(145)TAB(N);:PRINTCHR$(LE)
350 FORL=1TOSP:NEXT
360 TT=TT+1:IFTT=12THEN800
370 PRINTCHR$(145)TAB(N)CHR$(28)CHR$(46):PRINTCHR$(5)
372 BX=BX+8:BY=BY+8:POKEV+4,BX:POKEV+5,BY
380 GOTO120
800 FOR BD=1TO15:POKE53281,1:POKE53280,1:POKE53281,0:PO
```

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Listing continued.

```
      KE53280,0:NEXT
  802 POKEV+21,0:POKEV+4,24:POKEV+5,60
  805 PRINTCHR$(147):FORX=1TO5:PRINT:NEXT:PRINTTAB(15)"OH
      DEAR!!!":GOSUB1050
  808 PRINTCHR$(147):FORX=1TO5:PRINT:NEXT
  810 PRINTTAB(8)"YOU'LL HAVE TO BE FASTER":PRINT
  811 PRINTTAB(9)"TO SAVE THE CITY FROM"
  812 PRINT:PRINTTAB(7)"**** THE MAD L BOMBER ****"
  814 PRINT:PRINTTAB(7)"YOU DESTROYED ";MC;" L BOMBS !":P
      RINTCHR$(19)
  815 FORX=1TO1000:NEXTX
  820 GOSUB 2031
  830 PRINTCHR$(147):FORX=1TO5:PRINT:NEXT:PRINTTAB(7)"WAN
      T TO TRY AGAIN (Y OR N)"
  840 GETA$:IFA$=""THEN840
  850 IFA$="Y"THENPRINTCHR$(19):GOSUB2031:CLR:GOTO4
  852 IFA$="N"THEN860
  854 IFA$<>"N"THEN830
  860 END
 1050 FORXX=35TO0STEP-.2:POKESV,XX:POKESW,129:POKESA,15:
      POKESH,40:POKESL,200:NEXT
 1052 FORXX=35TO0STEP-.2:POKESV,XX:POKESW,129:POKESA,15:
      POKESH,40:POKESL,200:NEXT
 1054 POKESV,0:POKESW,0:POKESA,0:POKESH,0:POKESL,0:RETUR
      N
```

```
 2005 SV=54296:SW=54276:SA=54277:SH=54273:SL=54272:V=532
      48
 2010 PRINTCHR$(147):POKE53281,0:POKE53280,0:PRINTCHR$(5
      )
 2020 FORPT=1TO6:PRINT:NEXT:PRINTTAB(13)"L BOMB BUSTERS
      "
 2022 PRINT:PRINTTAB(13)"BY GARY FIELDS"
 2023 PRINT:PRINTTAB(18)"1983"
 2024 FORX=1TO400:NEXTX
 2025 PRINT:PRINT:PRINT"YOUR MISSION IS TO SAVE THE CITY
       FROM"
 2026 PRINTTAB(11)CHR$(18)"THE MAD L BOMBER!!"
 2027 PRINT"DESTORY THE FALLING LETTER BOMBS BY"
 2028 PRINT"PRESSING THE SAME KEY ON THE KEYBOARD":FORX=
      1TO1000:NEXTX
 2029 PRINTCHR$(19):FORPR=0TO63:READPQ:POKE832+PR,PQ:NEX
      TPR
 2031 FORDL=0TO500:NEXTDL
 2035 FORL=0TO24:POKESL+L,0:NEXT
 2040 POKESL+14,5:POKESL+18,16:POKESL+3,1:POKESL+24,143:
      POKESL+6,240:POKESL+4,65
 2050 FR=5389
 2060 FORFT=1TO50:FQ=FR+PEEK(SL+27)*3.5
 2070 HF=INT(FQ/256):LF=FQ-HF*256:POKESL+0,LF:POKESL+1,H
      F
 2075 PRINTTAB(10)"L BOMBS ARE FALLING":NEXT:POKESL+24,0

 2080 PRINTCHR$(147):RETURN
 4010 PRINTCHR$(147):FORX=1TO5:PRINT:NEXT:PRINTTAB(10)"V
      ERY GOOD FAST FINGERS"
 4012 PRINTTAB(16)"-YOU WIN-":PRINT:PRINT
 4014 PRINTTAB(7)"YOU BURST ALL ";MC;" L BOMBS"
 4015 PRINT:PRINT"THE HAPPY PEOPLE OF THE CITY THANK YOU
       !"
 4040 FORL=0TO24:POKESL+L,0:NEXT:POKESL+0,240:POKESL+1,3
      3:POKESL+5,8
 4050 POKESL+22,104:POKESL+23,1:POKESL+24,79:FORN=1TO19:
      POKESL+4,129
 4060 FORXT=1TO100:NEXT:POKESL+4,128:FORXT=1TO30:NEXT:NE
      XT
 4065 POKESL+22,0:POKESL+33,0:POKESL+24,0:POKESL+4,0
 4067 POKESL+1,0:POKESL+0,0:POKESL+1,0:POKESL+5,0:POKESL
      +22,0:POKESL+23,0
 4068 POKESL+33,0
 4069 FORX=0TO999:NEXTX
 4070 GOTO830
 6000 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0
 6001 DATA0,0,0,0,0,0,12,0,128,30,64,199,152,32,224, 218

 6002 DATA32,176,108,38,184,127,33,143,255,248,255,254,2
      9,254,0, 28
 6003 DATA7,255,157,3,255,248,1,255,193,0,0,6,0,0,0, 0
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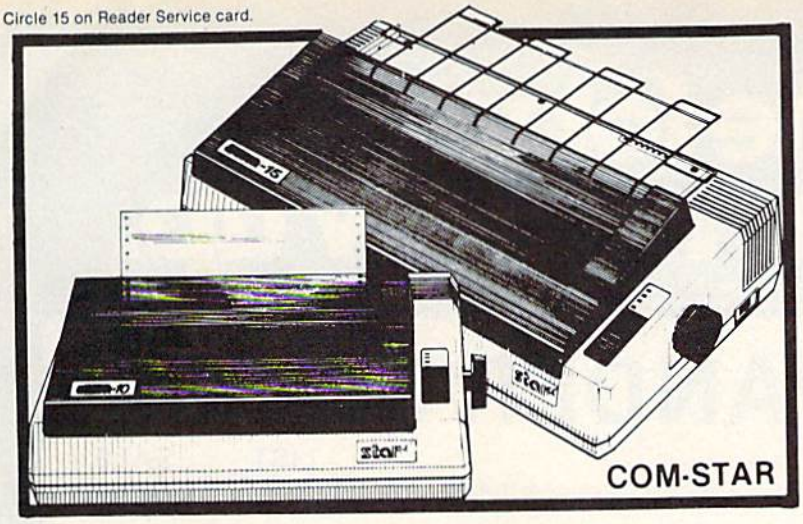

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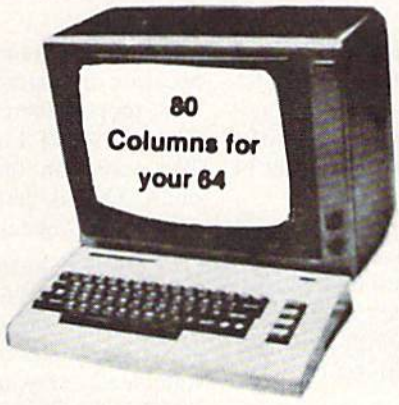

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Basic Speedup

Do your programs sometimes leave you hanging? Are you tired of waiting for minutes before your computer responds? Well, put more zip into your program's execution with these tips for speeding up programs.

By John Tanzini

How many times have you written a Basic program, only to find it executes so slowly that you never use it? Especially for children's educational software or for games, speed is critical in sustaining interest.

While your Basic programs will never run as fast as in machine language, if you pay attention to a few important techniques and understand Commodore's Basic interpreter, you can speed up execution times by a significant factor.

I have made careful measurements of the execution times for selected Basic statements. Each statement demonstrates some variation that either hastens or slows execution. I will show you how to time programs, even individual statements, using the real time clock.

All my measurements were made on a VIC-20, but most of what follows should be applicable to any Basic interpreter.

For...Next Is Better

Before getting into individual statements, I'd like to present the most dramatic technique I've found for speeding up programs. Consider the three-line program given below, which does nothing but execute a loop 1000 times.

```
100 REM WASTE TIME
110 N=N+1
120 IF N<1000 THEN 100
```

The loop executes in 9.40 seconds. Now let's try a program that does essentially the same thing, but replace the If...Then loop with a For...Next loop.

```
100 FOR I = 1 TO 1000
110 REM WASTE TIME
120 NEXT I
```

The execution time for the For... Next loop is only 1.70 seconds. A simple recoding of the loop into a more efficient structure makes it run five times as fast.

Before explaining how I made such accurate measurements, let me make one more change in the program. Change NEXT I in line 120 to NEXT. The execution time now is 1.47 seconds. That is better than six times as fast as the original version.

The lesson in these three short lines is very simple. Whenever possible, you should form your loops with For... Next statements instead of If...Then statements. If you use NEXT instead of NEXT I that will speed it up even more.

This technique is applicable to most programs, because any program that runs slowly contains a loop. If you fill your entire memory with a Basic program that executes one line after the next, it will reach the end of the program very rapidly. Programs slow down only when statements are executed repeatedly in loops.

The loops are the only parts of the program that really need attention. I don't advise even trying to optimize other parts of the program, as they will very likely run in milliseconds.

The actual programs used to measure the loops presented above contain four additional statements.

```
10 FOR I = 1 TO 500: NEXT I
90 A = TI
    .
    .
    .
1000 B = TI
1010 PRINT(B-A)*1000/60; "MSEC"
```

Line 10 simply wastes a little time so I can remove my finger from the return key before the actual program timing begins. I found, quite by accident, that the programs execute more slowly if I hold a key down while they are running.

Line 90 reads the real time clock. For those of you unfamiliar with the variable TI, it is simply the number of "ticks" of the real time clock that have

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occurred since power was applied to your computer. Each tick of the clock is 1/60 of a second.

After the variable A is set equal to TI, the loop that I am timing begins to execute. When the loop finishes, line 1000 is executed. This line reads the real time clock again, enabling us to determine the elapsed time.

Line 1010 calculates and prints the elapsed time. Dividing by 60 changes the time to seconds since each tick of the clock is 1/60 of a second. Multiplying by 1000 changes seconds to milliseconds.

Returning now to the If...Then loop, I shall illustrate something that I have long suspected. The version that I timed contains normal spacing, as shown in the text. Spaces are placed between variables, words and operators. One of the most frequently advocated methods for speeding up programs is to remove all the spaces. Let's try it.

The original version runs in 9.40 seconds, the version without spaces in 9.25 seconds. That represents less than a two percent increase in speed.

"Crunching" programs by removing spaces is a good way to save memory, but as far as speeding up programs—forget it. It makes programs so difficult to read that I advise crunching only if you are completely out of memory.

One of the reasons the If...Then loop is so slow is because it contains a branch. Every time the branch to line 100 is executed, the Basic interpreter starts at the beginning of the program and searches for line 100. This implies that if there were more statements before line 100, then the program would execute even more slowly.

To test this theory, I placed 50 short Basic statements in front of the loop. These statements were not part of the loop and were executed only once, but they caused the execution time to grow from 9.40 to 12.47 seconds. Imagine how slowly it might run if a loop like this were placed near the end of a long program.

Individual Statements

A tabulation of the execution times of some individual statements is shown in the accompanying table. The variable Z is set to zero before the timed statement is encountered, unless otherwise specified in the comments column.

Timing a single statement is slightly more complicated than timing a long program. I duplicate the statement 50 times, so that the time required to read the real time clock is negligible compared to the time spent executing the 50 statements.

This still is not long enough for an accurate measurement. The 50 statements are also enclosed in a For... Next loop and executed 100 times. Since the statement is executed a total of 5000 times, the final result is divided by 5000. The exact program used is shown below.

```
10   FOR I = 1 TO 500: NEXT
20   Z = 0
90   A = TI
100  FOR I = 1 TO 100
       .
       .
       .
160  NEXT
1000 B = TI
1010 PRINT (B-A)*1000/60/5000; "MSEC"
```

The first six entries in the table are variations on an assignment statement. The variable X is being assigned a value. Notice that X = Z (with Z already set to zero) executes faster than X = 0.

Does that make sense? The answer is yes. It takes the Basic interpreter longer to identify a decimal digit and change it into floating point format, than it does to look up a variable already in the proper format.

Entries 4, 5 and 6 in the table show that each additional digit slows the statement down by approximately 0.86 milliseconds. It takes about three times as long to set X to a value of 1000 (using X = 1000) than by using X = Z (Z having already been set to 1000).

This suggests a significant way of improving a program's speed. If a

Statement	Execution Time (msec)	Comments
1. X=.	1.17	
2. X=Z	1.35	Z set equal to zero if not otherwise specified.
3. X=0	1.71	
4. X=10	2.59	
5. X=100	3.45	
6. X=1000	4.31	
7. REM	0.31	
8. REM LONGER COMMENT	0.58	
9. X=EXP(Z)	5.08	
10. X=EXP(Z)	24.67	Z=10
11. X=INT(Z)	2.04	
12. X=INT(Z)	2.34	Z=55.55
13. X=RND(Z)	2.07	
14. X=RND(Z)	5.02	Z=1
15. X=TI	1.80	
16. X=TI:X=TI	3.52	
17. X=Z+Z	2.28	
18. XX=ZZ+ZZ	2.64	
19. X%=Z%+Z%	2.68	
20. X=Z*Z	2.20	
21. X=Z*Z	3.35	Z=1000
22. X=Z²	2.54	
23. X=Z²	50.04	Z=1000
24. GOSUB2	1.06	line 2 is a RETURN
25. GOSUB2000	2.96	line 2000 is a RETURN
26. IFX=ZTHENY=Z	2.30	X not equal to Z
27. IFX=ZTHENY=Z	3.55	X=Z
28. X=ABS(Z)	1.81	
29. X=PEEK(Z)	2.07	
30. X=POS(Z)	2.05	
31. S=SGN(Z)	2.03	
32. POKEZ,Z	1.76	

Table. Execution times of some individual statements.

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large constant is used within a loop, it would be better to assign the number to a variable and reference the variable inside the loop. This technique is usually applicable to Poking the sound registers and screen memory locations.

The effect of the cryptic statement (X = .) at the beginning of the table is to set X to zero. I personally do not like to use it, because anyone unfamiliar with the statement will have a hard time figuring out why X is being set equal to a dot. It does, however, execute faster than X = 0, so I keep it in my bag of tricks for when I really need it.

Statements 7 and 8 in the table show that longer REM statements actually do take longer to execute. REM statements execute fairly fast compared to other statements, but it still might be wise to keep comments outside of any critical loops.

Entries 9 through 14 demonstrate clearly that the execution time of certain functions is data-dependent. The time for statement 10 is not a mistake. It takes about five times as long to calculate the exponential of 10 than it does to calculate the exponential of zero.

Numbers 15 and 16 show that placing multiple statements on each line does not significantly increase execution speed. Executing X = TI twice on two separate lines would require 3.60 milliseconds, while executing X = TI:X = TI all on one line takes 3.52 milliseconds. That is only about a two percent increase in speed.

Statement 17 shows the time to perform an addition. Statement 18 shows that it takes longer when the variables have two-letter names (XX and ZZ as opposed to X and Z). Contrary to intuition, number 19 demonstrates that integer arithmetic is slower on Commodore machines than floating point.

Take a careful look at statements 20 to 23. Depending on the value of the number, it can take 15 times longer to square a number using Z^2 than it does using Z*Z.

Since almost every program contains subroutines, we should take a look at the two different GOSUB statements that appear next in the table. The reason that GOSUB 2000 takes three times as long as GOSUB 2 is two-fold.

First, it takes longer for the interpreter to read the number 2000 than it does to read the number 2. Second, the operating system searches for the line from the beginning of the program, just as it does for a GOTO statement. In my program, line 2 is the first line of the program, and line 2000 is the last.

Entries 26 and 27 in the table demonstrate, as you might expect, that the If...Then statement takes longer to execute when the If part of the statement is true. The remainder of the table shows times for some other functions supported by Commodore Basic.

An Example

I would like to present an example using some of the techniques I've been discussing. I have two different versions of a short program that determines whether the number 909091 is prime. A number is prime if it has no factors other than itself and 1.

The same basic algorithm is used in both programs. Every number from 2 to the square root of 909091 is divided into 909091. If the remainder is never zero, then the number is prime. You need not really understand the algorithm to see how the two versions differ, or to see the dramatic improvement in execution speed.

```
110 I = 2
120 Q = INT(909091/I)
130 R = 909091 - Q*I
140 IF R=0 THEN PRINT "NOT PRIME":
    END
150 I = I + 1
160 IF I<SQR(909091) THEN GOTO 120
```

Line 120 finds the quotient and line 130 calculates the remainder. If the remainder is zero, then I is a factor, the number is not prime and the program stops. Lines 150 and 160 control the loop.

Let me point out the elements of this program that slow down execution. First of all, the main loop is formed by an If...Then statement. It should have been coded as a For...Next loop.

The second worst offender is the 909091 appearing three places within the loop. It should have been given a variable name before entering the loop.

Notice also that extra computation is done within the loop. The program forces evaluation of the square root of 909091 every time the test in line 160 is performed.

Correcting these shortcomings, I arrived at the program shown below. Notice that this version combines the calculation of the remainder and the test all into one statement.

```
110 N = 909091
120 FOR I = 2 TO SQR(N)
130 IF N = INT(N/I)*I THEN PRINT "NOT
    PRIME": END
140 NEXT
```

While the first version of this program requires 79.9 seconds to execute, the second version runs in 9.60 seconds. It is true that this example is con-

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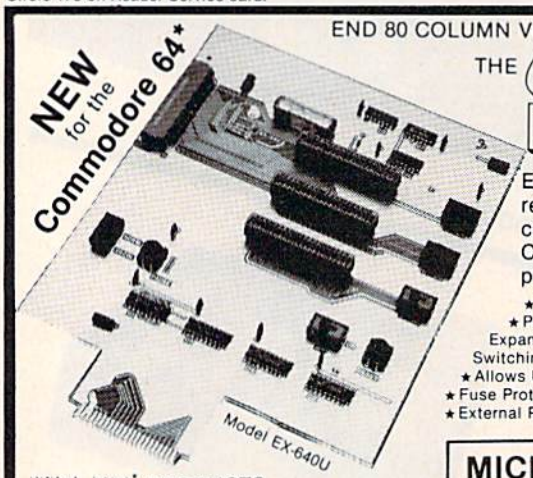

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trived, in that I tried to make the first version run slowly. The eight-fold increase in execution speed illustrates, nonetheless, how variations in coding make a significant difference.

When Not to Optimize

Before summarizing what you should do to speed up programs, let me point out what you should *not* do. Remember that it is only the loops that really consume execution time. Since optimizing programs for speed sometimes sacrifices readability, don't bother with lines that are executed only once.

Also keep in mind that some programs are intended to run only once to determine a specific result. Programs of this type may run in 10 minutes, but take a week to write. If that is the case, you should optimize your writing and debugging time by writing concise, logical code. After all, your time is much more valuable than your computer's.

Due to their VIC's limited memory, most VIC-20 owners have learned all the techniques for crunching programs. As soon as you purchase extra memory for your computer, you should forget how to crunch programs as fast as you learned.

I have not really touched on the best technique for speeding up programs: make sure that you are using the most efficient algorithm for solving your problem. Since every problem is different, I cannot give any general hints to finding the best algorithm. For any given algorithm, however, slight differences in coding can make a dramatic difference in speed.

Winding Down

Let me summarize what I consider to be the most important techniques for writing fast programs.

- Whenever possible, form loops with For...Next instead of If...Then statements. (By the way, it is not always possible.)
- Replace with variables any numeric constants to be used within loops.
- GOTOs and GOSUBs, which are encountered frequently, should be placed near the beginning of a program. Make the first statement a GOTO that branches around your subroutines to the main program.
- Replace X^2 with X*X.
- Keep comments outside of critical loops.
- Single letter variable names are faster than two-character variables.

Your attention to these simple rules sometimes can make the difference between useful and useless programs. R

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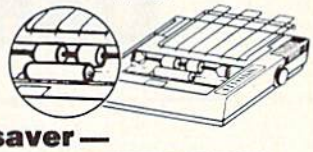

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Don't String Me Along

If the strings in your programs are getting you all tied up in knots, this article will help you unravel your puzzlement.

By Sharon Zardetto Aker

To many beginning programmers, a string is merely a word or sentence that they print on the screen and thereafter ignore. More experienced programmers, however, realize the versatility of strings: they can be compared, added, sorted, sliced, measured and converted to a number, and they generally add to the sophistication of a program.

String Comparisons

String comparison is done so often (IF A$=B$ THEN PRINT "CORRECT!") that you may not have realized you're using a symbol normally used in mathematics. If you can use the equals sign with strings, can you use the other relational operators >,<,<> (greater than, less than, not equal to) as well? Yes, indeed.

The use of <> is fairly obvious: IF A$ <> B$ THEN PRINT "WRONG". Although checking strings to see if they are the same has an obvious application for question-and-answer games, equal/not equal comparisons are also the basis for many search routines.

Take, for example, a small business that keeps a customer mailing list. Before the name from an incoming order is added to that list, it has to be checked against names already stored so there will be no duplication. With 100 customers in an array, C$, and the new purchaser, N$,

```
FOR X=1 TO 100
IF N$ <> C$(X) THEN NEXT X
```

will have the computer check the new name against the list. If the name is not found, it will complete the For-Next loop and follow the next command—add the new name to the list.

While "equal" and "not equal" are simple enough, using "less than" and "greater than" with strings is more technically intricate. When you ask the computer to compare letters, it is really comparing numbers, using CHR$ codes, so A<B, K<M, Z>V and V>R.

The computer compares strings by looking at one letter at a time, comparing the first letters of the words, then the second letters, and so on: ALPHA<BETA; GAMMA>DELTA. When one string runs out of characters, it is "less than" a longer string that begins with the same letters: ASP<ASPEN.

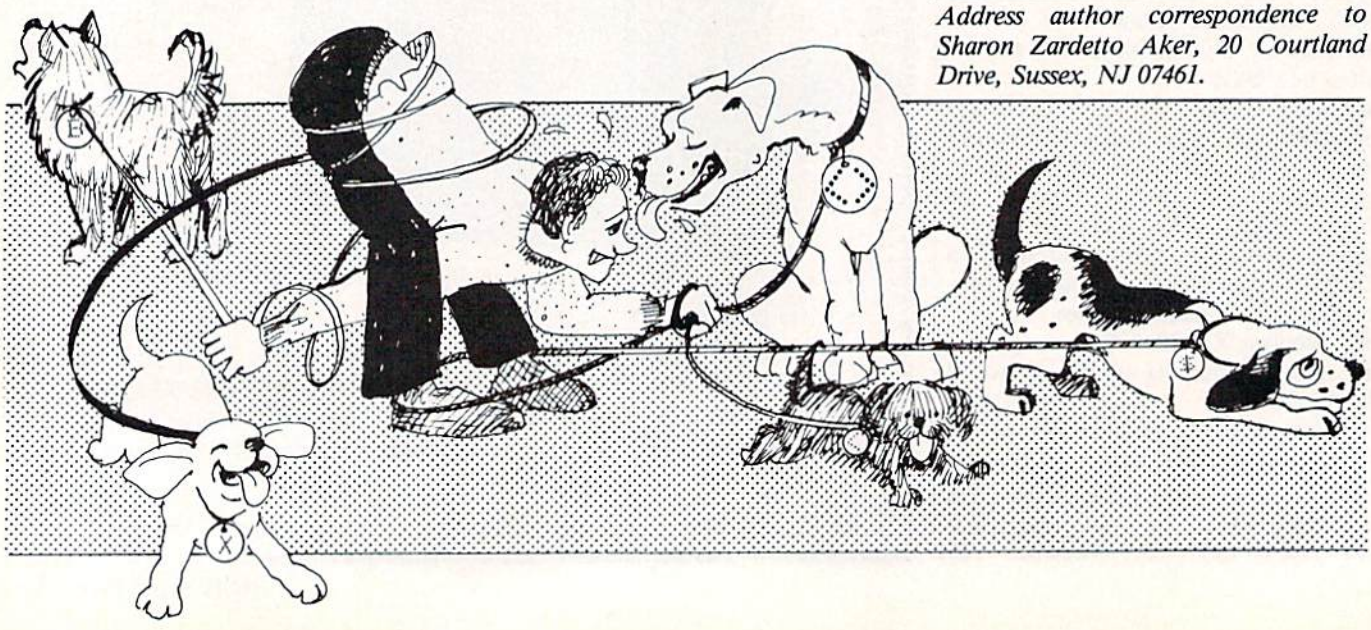
As you certainly have surmised by now, the relational operators are the crux of any alphabetical sorting routine. The following short routine will print any two words in alphabetical order:

```
10 INPUT A$,B$
20 IF A$<B$ THEN PRINT A$,B$
30 IF B$<A$ THEN PRINT B$,A$
```

Concatenation

The relational operators are not considered string functions, although you can use them for string handling. Another mathematical symbol that is not a string function but that you can use to manipulate strings is the + sign.

Address author correspondence to Sharon Zardetto Aker, 20 Courtland Drive, Sussex, NJ 07461.



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APROPOS TECHNOLOGY

Strings are not actually *added* together, which is why this operation is not called addition, but rather concatenation. Concatenating is simply tying two strings together: BASE + BALL results in BASEBALL.

To illustrate the difference between adding and concatenating, 123 + 456 = 579, while "123" + "456" = "123456". You'll find some applications of concatenation in the following discussion of string functions.

LEN

One of the simplest string functions on the Commodore is LEN, which measures the length of a string. LEN (A$) will give you the number of characters in A$.

You can use LEN to check that the person at the keyboard is following instructions:

```
10 PRINT"ENTER A FIVE-LETTER
   WORD"
15 INPUT A$
20 IF LEN (A$) <>5 THEN GOTO 15
```

The program will not continue until a five-letter word is entered.

LEN also can be used to center a word or sentence on the screen. Half the string should be printed before the center column of 20. With this in mind, you can set the TAB according to the length of the string.

```
10 FOR N=1 TO 6
15 READ A$:PRINT
   TAB(20-LEN(A$)/2)A$
20 NEXT N
25 DATA THESE,WORDS,ARE,
   CENTERED,AREN'T THEY?
```

Slicing

Slicing is the most versatile of the string-handling techniques. String slicing is just what it sounds like: taking part of a string.

LEFT$ slices from the beginning of a string, RIGHT$ starts from the end, and MID$ chops something right out of the middle. With LEFT$ and RIGHT$, you specify how many letters you want; with MID$, you have to indicate the position of the starting letter, plus the number of characters you want. If you don't use a second number with MID$, the computer will assume you want the rest of the string. For example:

```
A$=REACTION
LEFT$(A$,5)=REACT
RIGHT$(A$,2)=ON
MID$(A$,3,3)=ACT
MID$(A$,3)=ACTION
```

Try combining a little string slicing and concatenation:

```
10 A$="GODSON":B$="GRAND-
   FATHER"
15 C$=LEFT$(A$,3)+RIGHT$(B$,6)
20 D$=LEFT$(B$,5)+RIGHT$(A$,3)
25 PRINT A$,B$,C$,D$
```

Of the Commodore string functions, LEN is the simplest, slicing is the most versatile.

Slicing is an extremely useful tool. In cataloging the books in your personal library, you could use a string that includes the author, an abbreviated title and a two letter code for the type of book: science fiction, classic, computer science, novels, and so on.

```
ASIMOV,FOUNDATION-SF
TWAIN,CONN.YANKEE-CL
HARRISON,BYTEING-CS
LUDLUM,MATARESE-NV
```

By using RIGHT$(B$,2), you tell the computer to look just at the category of the book; incorporating that into a sorting routine can give you a categorized inventory.

String slicing can give interesting printing effects, such as printing one letter of a word at a time on the screen. (Of course, it always works that way, but too quickly for you to observe.) Try:

```
10 A$="SLOWLY"
20 PRINT LEFT$(A$,1);:GOSUB 80
30 FOR L=2 TO 5
40 PRINT MID$(A$,L,1);:GOSUB 80
50 NEXT L
60 PRINT RIGHT$(A$,1):END
80 FOR T=1 TO 750: NEXT:RETURN
```

Line 20 prints the first letter to the screen; line 40 prints each of the next letters; and line 60 prints the last letter. The semicolons after the parentheses in lines 20 and 40 keep the print position in place so that the letters will be printed on the same line. The subroutine is simply a delay loop.

VAL

Numbers inside strings have to be converted to "values" before you can do any mathematical manipulations with them. The VAL function will return the value of any number within a string.

Although strings can be concatenated, they cannot be added. VAL can let you do addition (or any other mathematical operation) with numerical strings. Consider the following:

```
A$="42":B$="24"
A$+B$="4224"
VAL(A$)+VAL(B$)=66
```

Why, you may ask, should a number be inside a string, anyway? Well, one reason is for ID information. A birthday that is stored numerically sometimes needs a leading zero. For example, does 12341 mean January 23 or December 3, 1941? The computer will not store 012341 as a number, but it will store "012341" as a string.

Perhaps you need to know how old that person will be in 1993, when the company pension plan will undergo a radical change. 93-VAL(RIGHT$(A$,2)) will tell you that the person will be 52.

STR$

The STR$ function complements VAL, in that it converts a number into a string. Again, you might ask why anyone would want to do that.

One reason might be to consolidate information into an easily stored string. If you have a string array (S$) containing the computer items you purchased, and a numeric array (N) in which you have entered their costs, you could convert that information into one string:

```
A$(1)=S$(1)+STR$(N(1))
```

Your A$ array might then look something like this:

```
A$(1)="COMPUTER299.95"
A$(2)="DISKDRIVE270.95"
```

and so on.

STR$ is used because strings are often more easily manipulated than numbers—in slicing, for instance, or in centering or other alignments. You may have noticed that the computer lines up numbers at the left margin:

```
43271
36
864
762895
```

If those numbers were put into strings, they could easily be justified at the right margin. The following program converts data numbers into strings and then manipulates them in a way similar to the centering routine explained above.

```
10 FOR N=1 TO 10
20 READ A:A$=STR$(A)
30 PRINT TAB(20-LEN(A$))A:NEXT N
40 NEXT N
50 DATA 34,5678,39,7,12345,7431,
   8754342,42,9215,6
```

You may have realized that you could simply assign each piece of data right into A$ and skip the STR$. This example program wasn't meant to be elegant, but merely to serve as a demonstration of STR$. You would be more likely to use the STR$ conversion when the numbers you want aligned have already been assigned numeric variables, perhaps as part of an array, so

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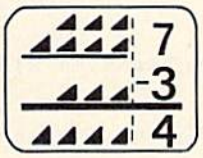

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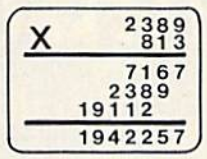

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that they can be manipulated numerically when needed.

Fun and Games

String slicing is eminently suited to word-play games. Scrambler is a program that makes use of all the string functions except STR$, and throws in some concatenation as well. It incorporates a scrambling routine designed by Dan Tookmanian.

```
10 PRINT"[SHFT CLR]"
20 PRINT"ENTER A WORD OF 5-10 LETTERS"
30 INPUT A$
40 IF LEN(A$)<5 OR LEN(A$)>10 THEN PRINT "I SAID 5-10 L
     ETTERS":GOTO 30
50 B$=A$:LA=LEN(A$):LB=LEN(B$):C=0
60 PRINT"[SHFT CLR]"
70 FOR N=1 TO LA
80 R=INT(RND(0)*LA)+1
90 S$=S$+MID$(A$,R,1)
100 A$=LEFT$(A$,R-1)+RIGHT$(A$,LA-R)
110 LA=LA-1:NEXT N
120 PRINT S$:PRINT
130 PRINT"PRESS 'G' FOR GUESS, 'C' FOR CLUE":PRINT
140 GET P$:IF P$=""THEN 140
150 IF P$="G" THEN 180
160 C=C+1:IF C=LB-1THEN 200
170 PRINT S$,,LEFT$(B$,C):PRINT:GOTO130
180 PRINT"WHAT IS YOUR GUESS?":INPUTG$:IF G$<>B$THEN PR
     INT"NO":PRINT:GOTO 130
190 PRINT"YOU ARE CORRECT"
200 PRINT"THE WORD WAS "B$
```

Listing of Scrambler game program—a demonstration of string functions.

Scrambler is for two players. The first enters a word that the computer will scramble and put on the screen; the second player has to guess what the word is. The guesser may ask for clues, and the computer will reveal successive letters of the answer until all but the last two are revealed.

Since this game is meant only as a demonstration of string functions, it is sort of a stripped down version of a computer game—no graphics, no sound, not even any scoring! Read through the program explanation and add some appropriate lines to polish it up—have the score tie into the value of C, which keeps track of how many clues had to be given.

Line 40 checks to see if the Input word is of the correct length. Line 50 assigns B$ the same value as A$, because A$ will be sliced to shreds during the scrambling procedure and will not be able to serve as the correct answer.

For the same reason, LB is needed to represent the length of the Input word; LA will be altered during the scrambling. C will serve as a counter for the number of clues asked for.

Lines 70–110 are the scrambling routine. First, a random number somewhere in the range of the length of A$ is chosen. The letter that occupies that position in A$ is put into S$, the scrambled word.

In line 100 the letter that has gone into S$ is removed from A$ by re-defining A$. A$ now consists of everything up to the removed letter, plus everything after it. LA is decremented by one because A$ is shorter by one character, and another random number has to be chosen within the correct range.

This procedure is repeated until all the letters have been randomly plucked from A$ and put into S$. (Notice that the For-Next loop is set up to equal the number of characters in A$.) A$ is now an empty string, so the player's guess will be compared to B$.

If the player asks for a clue, C is increased by one at line 160, and if enough clues have been given so that all but two of the letters are showing in order, the game ends. Since C is incremented at this line, LB-1 is the test for two letters left unscrambled. Notice the use of LB rather than LA, which equals zero after the scrambling routine.

At line 170, B$ is sliced to equal the number of clues asked for so far. Any time the player takes a guess, the guess (G$) is compared to B$. A wrong answer sends the program back to line 130, while a right answer is acknowledged. R

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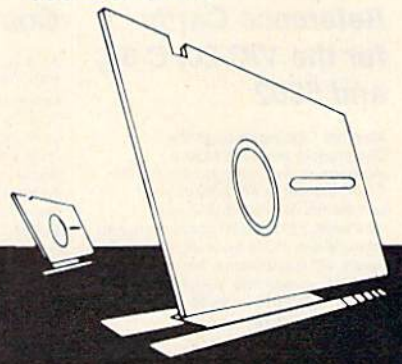

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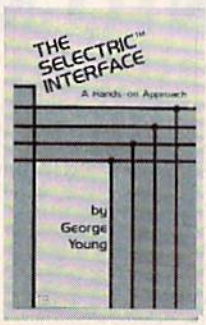

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Correction of line 3140 of the VIC-20 listing of the Artillery program in Double Your Pleasure With Conversion Magic, by Robert Black, in the January issue of *RUN*:

```
3140 X=A1:POKEFNCL(0)+30720,5:POKEFNCL(0),L1:
     FORX=A1+1TOA2-1:POKEFNCL(0)+30720,5
```

In the February issue, the Draw program, by David Busch (See Video Casino, p. 26), included a program listing for the VIC-20. We promised you a listing of that program for the Commodore 64 as well, and here it is.

```
10 REM ********
20 REM *      *
30 REM * DRAW *
40 REM *      *
50 REM ********
60 DIM D(10,2)
70 DATA -40,40,0,-1,-41,39,0,1,-39,41
80 FOR X=1 TO 10
90 READ D(X,1)
100 NEXT X
110 V=53248
120 PRINT"{SHFT CLR}"
130 B1=1024
140 DELTA=1
150 POKE 53281,1
160 VOLUME=54296
170 VCE=54273
180 WAVE=54276
190 ATTACK=54277
200 SUS=54278
210 CURSR=43:CO=2
220 GOTO 300
230 JV=PEEK(56320)
240 J1=JVAND16
250 F1=15-(JVAND15)
260 JV=PEEK(56321)
270 J2=JVAND16
280 F2=15-(JVAND15)
290 RETURN
300 GOSUB 230
310 GET A$:IF A$<>"" THEN GOSUB 430
320 GOSUB 480
330 IF D(F1,1)<>0 THEN DELTA=D(F1,1)
340 B1=B1+DELTA
350 IF B1>2022 THEN B1=B1+(D(F1,1)*-1)
360 IF B1<1024 THEN B1=B1+(D(F1,1)*-1)
370 IF B1>2022 THEN B1=B1+(D(F1,1)*-1)
380 IF B1<1024 THEN B1=B1+(D(F1,1)*-1)
390 POKE B1,CURSR:POKE B1+54272,CO
400 IF CO=1 THEN POKE B1+54272,5:POKE B1+54272,CO
410 IF J1=0 THEN PRINT"{SHFT CLR}"
420 GOTO 300
430 IF A$<"1" OR A$>"8" GOTO 460
440 CO=VAL(A$)-1
450 RETURN
460 CURSR=ASC(A$)
470 RETURN
480 POKE VOLUME,15
490 POKE WAVE,33
500 POKE ATTACK,128
510 POKE SUS,128
520 POKE VCE,72
530 POKE VOLUME,0
540 RETURN
```


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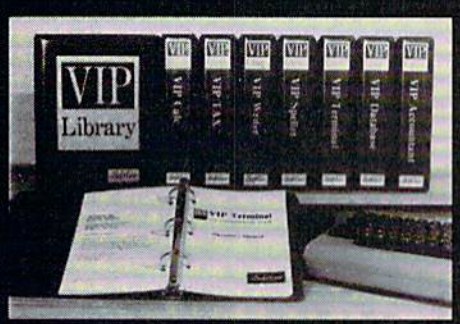

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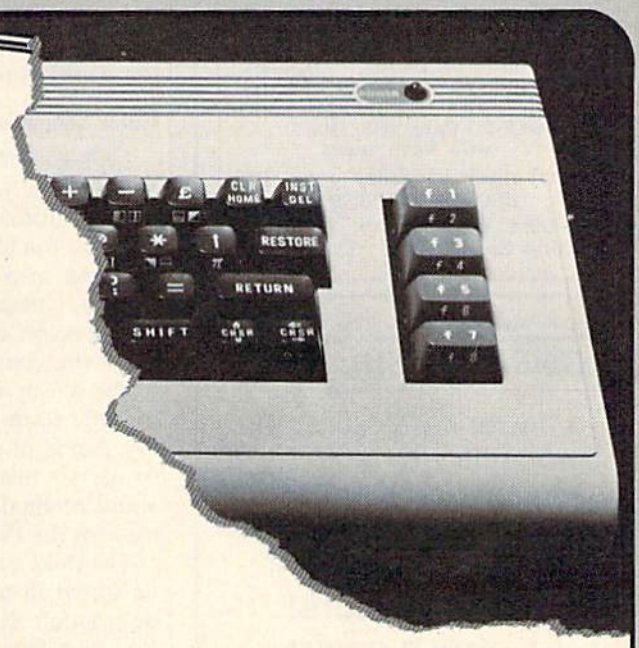
A Basic Excursion
Beyond the Manual

By Jeffrey Mills



This month's installment will take you deep into the steamy programming jungle, where you'll encounter—and tame—GOTO loops and Poke commands.

So far in this series, we've covered the use of several housekeeping commands, the use of variables, the Read command and the Data statement, and we've touched on GOTO loops. (Listing 1 shows the program we're developing in its current state.)

This month let's begin by discussing the GOTO loop a little further. In general, the concept of looping is just a method of doing the same thing over and over again. For example, if I ask you to open five paper bags and look into them, you'll do the same thing for each.

Writing an explanation of that process five times would be rather lengthy, but if I put the instruction inside a control loop, I need write it only once. The loop will perform the instruction five times.

To control a loop using a GOTO statement, you also need a check on the number of times you want to perform the instruction. You use the If...Then statement (pp. 37–39 in your C-64 manual) to check for any specific relationship between two or more pieces of data. The data can consist of variables, constants (the name for any non-variable data) or both.

In the case of the five paper bags, you'll count the bags as you get to them and stop when you've looked into all five. Another way to check would be to determine when there are no more bags left to look into.

Exiting the Loop

Translating this to the Catalog program, when you've printed all of the items in your Data statements, you stop printing. You accomplish this by providing some "dummy" data at the end of the Data statements. An unlikely tape number would be −1, and an unlikely game name would be EOF (standing for End Of File). Now add the dummy Data statement to your program by typing

```
9999 DATA -1, EOF
```

To make the program check for that data, you insert, "If tape number = −1, then stop printing." Translated from English to Basic, that reads: If N = −1 then [exit the loop].

In structured programming, it's a good idea to check looping control conditions at the beginning of the set of looped instructions. To do this, you need to add the check at line 65. (The start of the loop is the Read statement, line 60.) Type:

```
65 IF N = -1 THEN GOTO 90
```

This instruction checks to see if the program has reached the dummy data. If it has, the program goes to line 90; if not, it "falls through" to the next line, line 70. When it gets to line 80, it returns to line 60, where it reads the next item in the Data statements and checks again to see if it's time to exit from the loop. The looping continues until the dummy data is encountered.

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Since you've told the program to continue at line 90, you must add that line so the program has somewhere to go. If the line designated by a GOTO doesn't exist, the program will terminate in an error. It's a good idea to put a remark at line 98 indicating the end of the loop. Type:

```
90 REM *** END OF LOOP ***
```

As you develop your programming skills, you'll find many more uses for the If...Then statement. I'll discuss those uses as we come to them.

Color Schemes

Let's go back to the Print statement and see how you can get more exciting output from your Commodore. It might be fun to have your catalog listing print out in color, and you might also like to change the background and border colors of the screen.

All the controls for outputting data to the screen are permanently coded in numeric form in the computer's memory. Some of that memory is available to use so that you can alter the way your Commodore acts. You can do this through the Poke command.

The Poke command will alter the value stored in a specified memory location. Don't worry; it's not permanent. You can change it again with another Poke. Also, the system resets to its original values when you shut off the computer.

Thus, you can change the values stored in the locations controlling the border and background colors of the screen. Location 53280 controls the screen border and location 53281 controls the background color. Table 1 shows the values to Poke into those locations for the various colors.

You can place any of these values into either of the memory locations controlling the screen colors. The correct format for a Poke command is:

```
POKE 53280, 7
```

You can enter the Poke command directly from the keyboard or you can execute it from within a program. Go ahead...try a couple of different values in those locations.

Keep in mind that when you choose a background color, it should be one that's compatible with the color chosen for the letters. Some letter colors don't show up well against certain background colors.

For the Catalog program, let's keep the screen sort of mild. A gray border around a black background is probably a good choice, but you can use any color you'd like. To use gray and black,

Poke lets you alter the way your C-64 acts.

Color	Value
Black	0
White	1
Red	2
Cyan	3
Purple	4
Green	5
Blue	6
Yellow	7
Orange	8
Brown	9
Pink	10
Gray 1	11
Gray 2	12
Lt. Green	13
Lt. Blue	14
Gray 3	15

Table 1. Poke values for the C-64 colors.

```
10 REM *** PROGRAM/TAPE CATALOG ***
20 REM *** WRITTEN BY: YOUR NAME **
30 PRINT "{SHFT CLR}"
40 PRINT"{14 SPACEs}TAPE CATALOG"
50 PRINT
52 PRINT"TAPE", "PROGRAM"
54 PRINT"NO.", "NAME"
56 PRINT
60 READN,P$
70 PRINTN,P$
80 GOTO 60
9000 DATA 101,GAME 1,101,GAME 2
9010 DATA 102,GAME 3,102,GAME 4
9020 DATA 103,GAME 5,103,GAME 6
```

Listing 1. The Catalog program as developed so far.

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add the following statements to the beginning of the program:

```
25 POKE 53280, 12: POKE 53281, 0
```

Notice that you can put more than one instruction in a single line. You do this by separating the instructions with a colon (:). You should note here that if REM is the first "word" on a line, execution of that entire line is ignored. If you want to use REM in a multiple statement line, use it as the *last* statement in the line.

There is no one specific place in the user's manual that covers colors and printing in color. You'll have to check the index for the various pages.

Embedding Commands

You can add embedded commands, which I mentioned briefly in the first article of this series, to the Print statements in a program to create various results.

When you type a Print statement, certain key combinations entered after the opening quotation marks will act as codes to determine the color of whatever follows (within the quotes) when the program is run. When you use this method of altering colors, a reverse symbol will appear on the screen to indicate the color chosen.

If you type in these color key-codes in direct statements (*not* embedded within quotation marks), the symbols will not appear; the color of whatever you then type in merely changes. Table 2 shows the key combinations for the various colors, along with the indicative symbols that appear if the command is embedded within quotation marks.

Now try making the title heading on your catalog listing yellow. List the program, move your cursor up to line 40 and position it right after the first quote

You can become a color magician by learning the keycodes available on your Commodore 64.

```
10 REM *** PROGRAM/TAPE CATALOG ***
20 REM *** WRITTEN BY: YOUR NAME **
25 POKE 53280, 12: POKE 53281, 0: REM *** SCREEN COLORS
    ***
30 PRINT "{SHFT CLR}"
40 PRINT"{CTRL 8}{14 SPACEs}TAPE CATALOG"
50 PRINT
52 PRINT"{COMD 6}TAPE", "PROGRAM"
54 PRINT"NO.", "NAME"
56 PRINT
60 READN,P$
65 IF N = -1 THEN GOTO 90
70 PRINT"{CTRL 4}"N,P$
80 GOTO 60
90 REM *** END OF LOOP ***
9000 DATA 101,GAME 1,101,GAME 2
9010 DATA 102,GAME 3,102,GAME 4
9020 DATA 103,GAME 5,103,GAME 6
9999 DATA -1,EOF
```

Listing 2. Program illustrating embedded color commands.

```
10 REM *** COLOR SAMPLER ***
20 PRINT"{SHFT CLR}":REM * CLEAR THE SCREEN
30 FORB=0TO15:REM * EACH OF THE SIXTEEN BORDER COLORS
40 POKE53280,B:REM * ALTER MEMORY TO DISPLAY COLOR
50 FORS=0TO15:REM * EACH OF THE SIXTEEN SCREEN COLORS
60 POKE53281,S:REM * ALTER MEMORY TO DISPLAY COLOR
65 PRINT"{SHFT CLR}":REM * CLEAR SCREEN
70 FORP=0TO16:REM * EACH OF THE SIXTEEN PRINT COLORS
80 POKE646,P:REM * ALTER MEMORY TO DISPLAY COLOR
90 PRINT"{HOME}{10 CRSR DNs}{5 CRSR RTs}{CTRL 9}{4 SPAC
    Es}BORDER COLOR ="B"{CRSR LF}{10 SPACEs}{CTRL 0}"
92 PRINT"{HOME}{7 CRSR DNs}{5 CRSR RTs}{CTRL 9}{4 SPACE
    s}SCREEN COLOR ="S"{CRSR LF}{10 SPACEs}{CTRL 0}"
94 PRINT"{HOME}{13 CRSR DNs}{5 CRSR RTs}{CTRL 9}{5 SPAC
    Es}PRINT COLOR ="P+1"{CRSR LF}{10 SPACEs}{CTRL 0}"
100 FORA=1TO250:NEXT:REM * PAUSE LOOP TO SLOW DOWN THE
    PROGRAM
101 REM * THE LARGER THE VALUE AFTER THE 'TO', THE SLOW
    ER THE PROGRAM
110 NEXT
120 NEXT
130 NEXT
140 END
```

Listing 3. Program showing all color combinations possible on the C-64.

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in that statement. Then press the shift and INST/DEL keys and type:

CTRL 8

Press the return key. You should now see a reverse π as the first character to be printed. (See Listing 2.) The color of everything printed thereafter will be yellow until you change it to some other color or press the run/stop and restore keys.

Now make the column headings light green. Following the above procedure, alter line 52 to include a LOGO 6 as the first character to be printed. Since this will change the printed color to light green until it is changed again, try adding one more color character to line 70. This will change the color of all the program output (the Catalog listing itself). How about cyan?

This insert will have to include a beginning quote, the CTRL 4, and an end quote. Line 70 should now read:

70 PRINT "[reverse shift-*]"N, P$

There should not be a space between the quotes and the reverse character. If there were, the space would print also, throwing the printed columns out of alignment.

Keys Pressed	Color	Reverse On Screen
CTRL 1	Black	Shift-P
CTRL 2	White	E
CTRL 3	Red	British Pound
CTRL 4	Cyan	Shift-*
CTRL 5	Purple	Logo- —
CTRL 6	Green	Up Arrow
CTRL 7	Blue	Left Arrow
CTRL 8	Yellow	π
LOGO 1	Orange	Spade
LOGO 2	Brown	Shift-U
LOGO 3	Pink	Shift-V
LOGO 4	Gray 1	Shift-W
LOGO 5	Gray 2	Club
LOGO 6	Lt. Green	Shift- —
LOGO 7	Lt. Blue	Diamond
LOGO 8	Gray 3	Shift-+

Table 2. Key combinations and symbols for the C-64 colors.

Wheeling Colors

To see all the color combinations available on your C-64, type in a short program (Listing 3) after saving your Catalog Listing program. The program in Listing 3 will run through a series of loops. However, these loops are For... To...Next loops, which we'll discuss in a future article.

Next month I'll discuss controlling your program's output, allowing for more than one screenful thereof and directing the output by having the computer ask questions. R

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Clubs

Rockville, MD

Persons interested in joining the Rockville VIC/64 User's Group should write to P.O. Box 8805, Rockville, MD 20856 or contact Thomas Pounds at 301-231-7823.

The group's newsletter is called the *VIC/64 User's Bulletin.*

United States Commodore User's Group

The USCUG is the largest VIC-20/C-64 user's group in the United States. It is non-profit, organized solely for the purpose of assisting users.

For more information, write to USCUG at P.O. Box 2310, Roseburg, OR 97470.

Orange County, CA

The Orange County VIC-20/C-64 User's Group holds their meetings on the fourth Saturday of each month, from 1:00 to 5:00 PM. The meetings will be held in the public meeting room at Mercury Savings and Loan Association on Edinger Ave., just west of Beach Blvd., Huntington Beach.

If you'd like to receive their newsletter, write to Bob Dingwall, 5832 Raphael Drive, Huntington Beach, CA 92649.

Salt Lake Area

The Salt Lake area's VIC-20 and C-64 user's club is called Mountain Computer Society.

VIC-20 meetings are held on the last Thursday of each month, while C-64 meetings are held on the last Tuesday. Both meet at Murray High School.

You can contact the group by writing to P.O. Box 1154, Sandy, UT 84071 or calling Benjamin Guasto, Public Affairs Chairman, at 801-571-6813.

Commodore 64 West

For those of you in the areas of Santa Monica Bay and west Los Angeles, the Commodore 64 West User's Group is for you. Contact Don Campbell, 2917 Colorado Ave., Santa Monica, CA 90404 (213-828-9308).

COMAL User's Group

Are you interested in learning about COMAL, a language whose advocates claim is destined to replace Basic?

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Buffalo, NY

The Commodore Buffalo User's Group, composed mostly of C-64 owners, also supports the PET series.

The group meets on the first and third Thursdays of each month. For more information, call 716-631-3932 or write to COMBUG, 199 Dale Drive, Tonawanda, NY 14150.

Pomona Valley, CA

The Pomona Valley Commodore User's Group meets at the California State Polytechnic University in Pomona. Both general and technical meetings are held three times monthly. The group has an extensive public domain library for both the C-64 and the VIC-20.

The group offers a free Basic programming course, public domain programs at each meeting, discounts on software at local computer shops and a software raffle.

Contact: David Dietzel, 1518 Darby Ave., Pomona, CA 91767, (714) 621-7210 or Mark Joerger at (714) 620-8889.

East Central Illinois

The Champaign-Urbana Commodore User's Group (CUCUG) formed five months ago and boasts over 100 members, some from as far away as the Chicago area.

Monthly meetings are held at the University of Illinois Vet Medicine Building and cover topics ranging from basic machine workings and software reviews to highly technical workings of the interiors of Commodore products. Members are primarily 64 owners, but the group is composed also of VIC and PET users.

The group, which is in the process of compiling an extensive public domain library, provides its members with a monthly newsletter and technical service. Interested persons should contact Steve Gast, president, or Jeff Stevenson, secretary, at the club's address: 2006 Crescent Dr., Champaign, IL 61821, or call Steve Gast at (217) 352-9681.

Silicon Valley, CA

The Silicon Valley Commodore Computer Club (formerly the VIC User's Group) is expanding to support the C-64.

The club offers lectures, demos, an open forum for questions, two ac outlets per seat, a newsletter, public domain software for the VIC and 64 and beginning and advanced classes to start in January.

The group meets on the third Wednesday of every month in the Dysan Auditorium at 7:00 PM. Contact Michael Jerome Fisher, president, at 415-948-2985 or 415-961-1969.

Ludington, MI

The computer club for this area is called the Tri-County Computer Club. For more information, write to Mrs. Schoenmaker at 501 E. Loomis, Ludington, MI 49431.

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Book Gallery

Compiled by Shawn Laflamme

The User's Guide to Commodore 64 & VIC-20 Computers, Software & Peripherals

Editors of *Consumer Guide*
Publications International, Ltd.
3841 West Oakton St.
Skokie, IL 60076
Softcover, 80 pp., $4.98

The *User's Guide to Commodore 64 & VIC-20 Computers, Software & Peripherals* is so good I'd recommend packing a copy with each new computer. This attractive book starts off with full-color, clear photographs showing how to hook up the system. Each procedure is described in numbered steps using both text and pictures. Alternative procedures are clearly noted.

For example, the rf modulator is built into the C-64; the procedure tells the C-64 owner to skip over the steps needed to hook the modulator to the VIC.

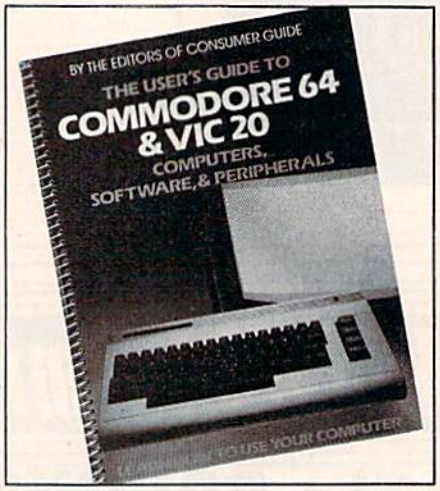
The book's spiral binding allows the 8½ × 11 pages to lie flat for easy use. An open layout of readable text and clear pictures is so easy to follow that the most insecure new user should have the confidence to hook up his new computer with these instructions.

The best feature of the book is the chapter entitled "Meet the Keys." This section occupies most of the book's 80 pages. It takes each special key on the board and describes its functions. Each key covered takes at least a page, which features in the upper left corner a close-up of the key, and displays a picture of the keyboard with the key circled in yellow at the end.

The text describes the functions of the key and prescribes short exercises using it. Each exercise is illustrated with a picture of the screen showing what happens when the key is used.

The text is easy to understand. The authors use colored print to name the key, bold print to highlight references to the screens and italics to note definitions of new words.

If you go through the keys page by



page, you'll learn a lot of necessary conventions for operating your computer. For example, the page on the number keys warns about using the letter O for the number zero. Shortly after, two pages on the parentheses keys cover order of arithmetic operations. An explanation about using numbers in programs faces the page on the quotation mark key, which, incidentally, introduces the reader to strings. The explanations covered enough ground so that even an old Commodore user like me learned a couple of new points.

The section on peripherals seems short to an experienced user, but it covers all the issues that confront a novice. In five pages, it covers how to decide which peripherals to buy, including monitors, printers, disk and tape drives, modems, game controllers, memory expansion and graphics and sound tools. None are covered in detail, but the essential criteria are given for choosing a monitor versus a TV, a letter-quality printer versus a dot-matrix and Commodore peripherals versus those of other vendors.

Specific recommendations are made by brand. While no brand is singled out as unworthy, the authors warn against using printer parallel-to-serial interfaces that attach to the Commodore user port.

A section on software follows. The step-by-step procedures for loading and saving programs are excellent. A general discussion of how to choose and care for software is short, but to the point. Specific programs are recommended in the categories of games, education, word processing, home finance and databases.

A final chapter entitled "Your Computer's Network," includes a user-group directory, a list of Commodore magazines, phone numbers for Commodore computer bulletin boards and the basics of using computer bulletin board systems. The lists are incomplete, but do demonstrate the kinds of resources available to newcomers.

Much of this book is old hat to the experienced Commodore user. He might disagree with some of the recommendations, or want to add material not covered in it. But the newcomer will find it addresses most of his areas of insecurity.

Many of the conventions that "everyone knows," which most often frustrate and discourage the novice, are covered. The book is short enough to be manageable for the least-dedicated new user. It provides a solid base of knowledge which is rooted in the necessary time "plunking on the keys." Programming is not addressed, but the book is an excellent preliminary introduction to learning programming.

This book is part of a series which includes machines such as TI, Apple, and

Atari. If the others in the series are as good as this one, we finally have good beginning material for the inexperienced new users who are entering the computer world in droves.

Annette Hinshaw
Tulsa, OK

Commodore 64 Programmer's Reference Guide

Commodore Business Machines, Inc.
Howard W. Sams & Co., Inc.
4300 W. 62nd St.
Indianapolis, IN 46268
Softcover, 468 pp., $19.95

The *Commodore 64 Programmer's Reference Guide* is an excellent resource for the home computer programmer. Its nearly 500 pages cover all of the Commodore 64's features in greater depth than the *User's Guide* that accompanies the Commodore 64.

As stated in the book's introduction, the "*Reference Guide* is not designed to teach the Basic programming language or the 6502 machine language." It does, however, offer an in-depth, informative guide for the serious home programming enthusiast.

The *Reference Guide*'s first chapter is entitled "Basic Programming Rules." This chapter goes into the standards of line-numbering, mathematical operation hierarchy and other similar topics. Even a veteran programmer will most certainly pick up a few useful tips in reading this section.

The second chapter is a dictionary of Commodore's Basic vocabulary. The dictionary gives examples and rules for usage, as well as a general description of the commands. Included in this section is a discussion of the powerful screen-editing capabilities offered by the Commodore 64.

The book then moves on to a detailed examination of the various graphics and display modes incorporated in the Commodore Video Interface Chip (VIC-II). There are discussions of character display modes, bit map modes and sprite graphics. These discussions are thorough and filled with easy-to-follow, well-documented examples of programming in each of these areas.

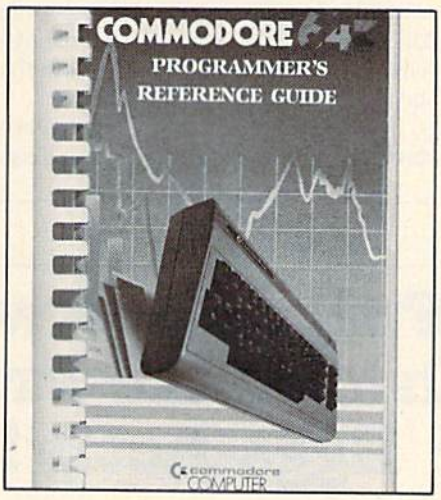
All example programs show a wide variety of programming techniques. Most of the techniques may be applied to programs of your own design quite efficiently.

There are numerous tables condensing all of a particular section's data into one convenient page. This creates a quick reference point for refreshing your memory after you have begun exploration on your own.

The fourth chapter is devoted to "Programming Sound and Music on Your Commodore 64." Included is a discussion of the basics of synthesized music creation, incorporating both the theory of music and the varied capabilities of the 6581 Sound Interface Device (SID Chip).

This chapter is also full of well-documented charts and programs to aid in the development of programs using the SID Chip.

Machine language, the very thought of which sends shudders up many a Ba-



sic programmer's spine, is the topic of chapter five. Using simple, easy-to-comprehend language, machine language programming is presented in such a way as to make wary programmers feel more comfortable in this area.

Included in this chapter are a dictionary of the instruction set used by the MCS6510 Microprocessor Chip (the "brain" of the Commodore 64), a series of various block memory maps of the internal layout of the Commodore's memory and a detailed memory map, showing where all of the Commodore's flags, vectors, pointers and registers are located. This last is an invaluable tool for Basic and assembly programmers alike.

The last chapter of the guide covers input/output, with explanations of the various interface ports within the Commodore 64. A variety of I/O applica-

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tions are covered briefly, including joysticks and paddles (examples are in both Basic and machine language), RS-232, the user port, serial bus and expansion port. A very brief mention of the Z-80 microprocessor with CP/M is also included.

The final 100-plus pages of the guide are devoted to numerous appendices covering everything from key word abbreviations and music note values to technical characteristics of the computer.

Attached to the rear cover of the book is a schematic of the Commodore 64. While not complete enough for repair work, it should provide plenty of thrills for the hardware enthusiast.

With this book, Commodore and Howard W. Sams have done an excellent job of filling the gaps left by the standard user's guide that accompanies the Commodore 64. It should become the mainstay of every serious Commodore 64 programmer's library of manuals.

Jeffrey A. Mills
Columbus, OH

Tricks for VICs

Sam Roberts
Elcomp Publishing, Inc.
53 Redrock Lane
Pomona, CA 91766
Softcover, 115 pp., $9.95

Tricks for VICs contains listings for 14 ready-to-run programs plus a discussion of machine language programming and various hardware projects.

The programs presented include a word processor, a simple monitor and several games. Each program has a short paragraph describing how to use the program, but no information about how it works. Full listings for each program are included even though some are reduced to fit the small page size. Be careful when entering programs—some of the graphics and cursor control characters may be hard to read from the book.

The discussion of machine language programming is only eight pages long, with one page being a copy of the instruction chart for the 6502 microprocessor. The material really only glosses over the subject, spending more time with a utility program called Poker Maker for Poking machine language routines into Basic data statements.

The sections on hardware projects spend about 25 pages discussing a 16K RAM/ROM board and a Universal Experimenter board, both available from Elcomp Publishing.

If you're not into soldering and playing with the hardware, you won't find these sections of much interest. To use one of the boards you'll actually have to open up the VIC-20 and add a few wires.

The sections on I/O programming do show some interesting experiments that should help in learning the operation of the 6522 VIA chip connected to the user port. There are a few pages that show how to use the VIC to control external high power devices and how to connect three joysticks to the VIC.

Robert W. Baker
Atco, NJ

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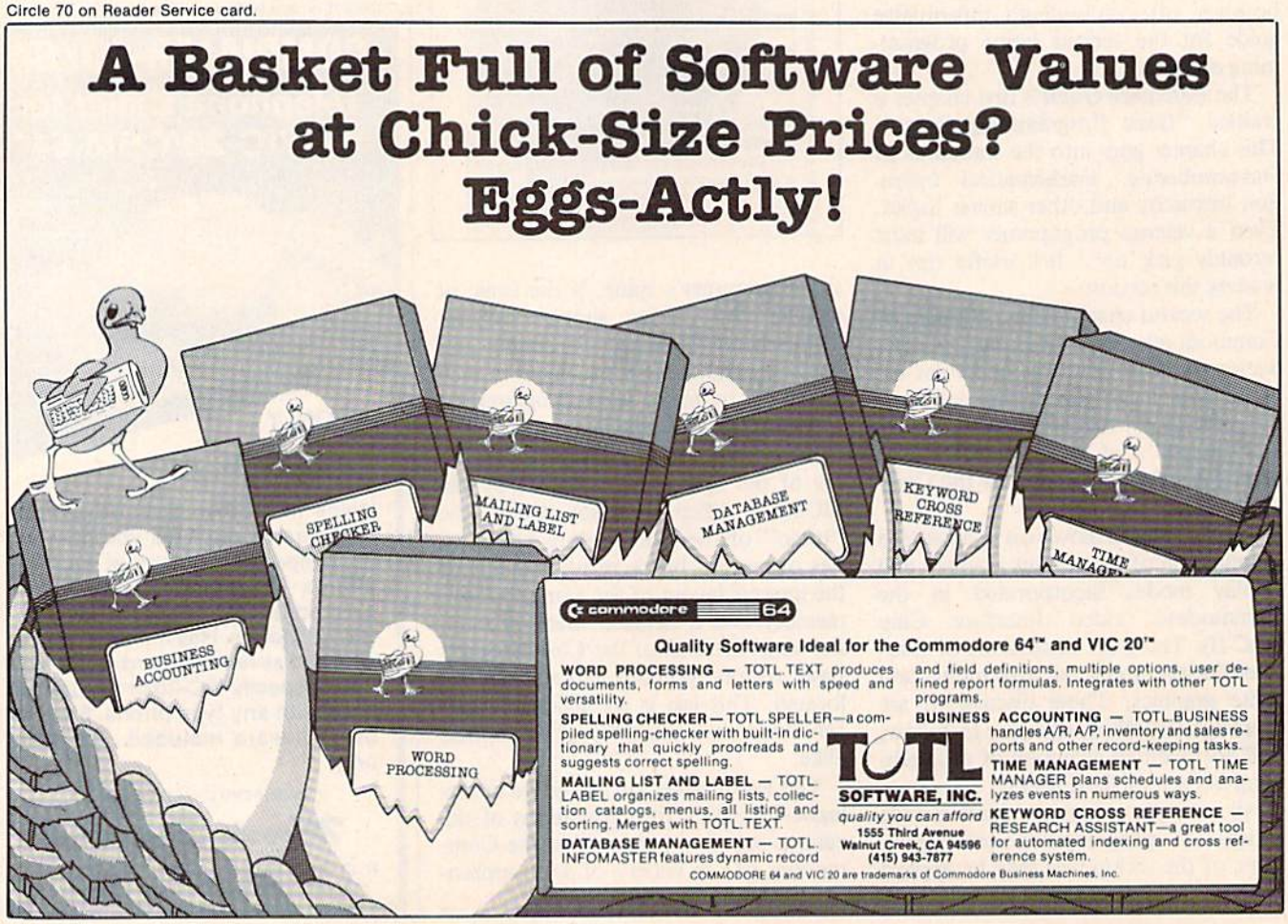
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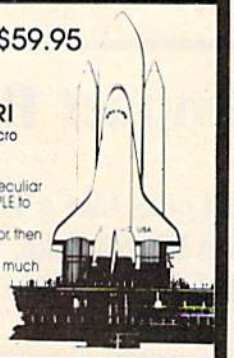

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Hardware Gallery

Compiled by Marilyn Annucci

Impact Printer

It Looks Like a Toy, But It's No Joke. This Printer Is for Real.

It's 4×4½ inches, and it carries around a roll of adding machine paper like a snail's shell.

And it prints.

Not on full-width paper, and not using a letter-quality daisy-wheel, but it prints. On 2-inch wide paper, with clear, dark, purple dot-matrix characters and symbols.

It's called Impact Printer, and I must admit I didn't really take it seriously when I first saw it. I thought it might be some kind of toy printer—something like those old tin typewriters kids used to get at Christmas (before they got 64K computers that could calculate the speed of light and the number of hairs on a Rhodesian Ridgeback). But I learned better.

Hooking It Up

First, I tried to hook up the printer to my Commodore 64. The instructions have been written in such a way as to make that feat somewhat difficult. It may be a trick to stop you from laughing at the thing and sober up, but I wish they would put up with the laughter and simply tell you where to plug what and let it go at that.

(An example of the way the instructions are written will illustrate my point. "The continuous printing of high dot density patterns may adversely affect the longevity of the print head." That sentence alone is bigger than the printer, and it hasn't even gotten to the Power Up Procedure yet.)

But I did manage to get the thing hooked up, and I put it on top of my disk drive, where it sits looking like a small adding machine without a keyboard.

And whenever I want it to do something, I type in OPEN 4,4,0 or OPEN 4,4,7 (depending on which printing mode I want to use—it has two), then PRINT#4, followed by whatever I want printed, and off it goes.

It makes small wheezing noises (much of what it does is small, in keeping with its nature), then grinds its way through the printing process (and "grind" is the best word I can think of to describe the sound it makes), and advances the paper a few notches (but not quite enough to clear the plastic tear-off shield, for some reason), then stops. Waiting for the next task.

It must be some kind of joke.

No, it isn't. It is a very small, but really quite adequate printer, especially for anyone who wants to list programs or print anything that doesn't require full-size letter or fanfold paper.

What It Does

It accepts direct commands, so long as they include its name and address (the format of the Open command). Direct commands might be for making quick notes, using the computer's keyboard as you would a typewriter, or for trying out a graphic command before sending it to a big printer.

The basic number of characters-per-line this printer prints is 24, but, by including a CHR$ code at the start of the commands or program, it will print 32 or 40 columns.

At 24 columns (24 characters-per-line), the printing is clear, sharp and easily read. At 32, it is still good. At 40, some of the characters and symbols, particularly those with diagonals (such as W or X), begin to break up and become almost too light to see. Therefore, the uses of the 40-character mode might be limited. It would not work well for text (from a word processor, for instance), but it could be of real value in drawing charts or other graphic devices.

Used with a full program, the Impact Printer can do almost everything other dot-matrix printers can do. It can print at twice the normal height. It can reproduce all of the graphic symbols the Commodore has to offer, and even has a command that will pull lines closer together so that all vertical symbols can be joined and boxes formed. Further, using a relatively simple formula, the printer can be programmed to create new characters.

It will reverse print—white characters on a black (purple) background—but the instructions warn against doing much of this; besides, the grinding sounds it makes when printing reversed lines are frightening.

I have used the Impact Printer with a word processing program, and it behaves very well. If the length of the lines on the screen don't match the mode the printer is in, some words will be split arbitrarily.

If, however, the word processing program's line length is adjusted to the printer's column size, the printer will reproduce exactly what the screen shows. I set up the line length in the word processing program to 24 and left the printer at that setting—it produced lengths of 2-inch wide tape with purple type that was clear, sharp and readable. That's about all most computer users need most of the time.

Evaluation

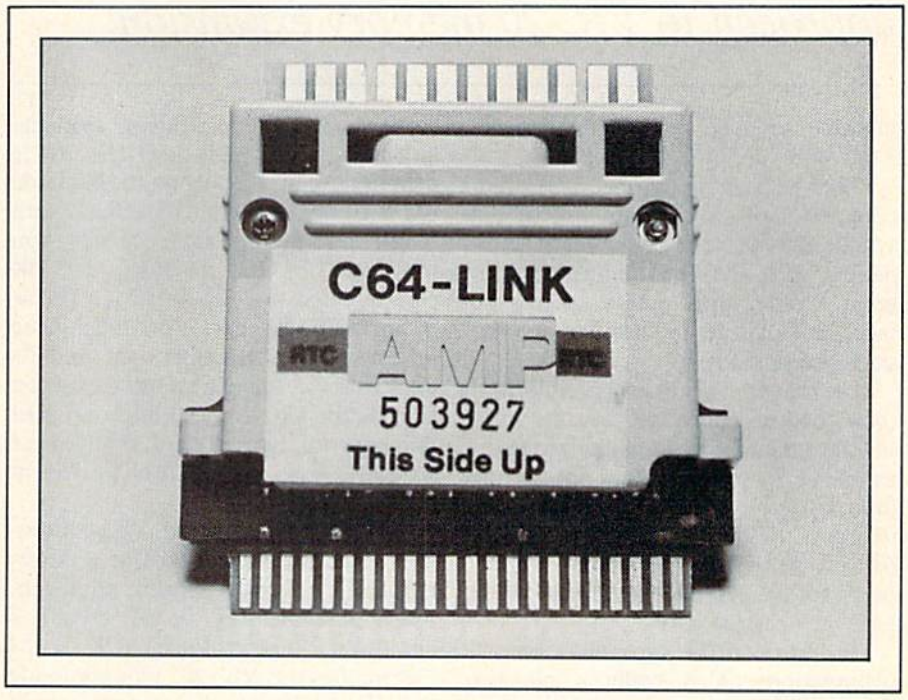
There really is no way to compare this printer with standard printers, as this does not pretend to do what others do as far as turning out full-page documents. This printer has a remarkable range for something that looks like a toy. It's ideal for when you're just fooling around with the computer. Just in case something needs to be recorded.

In short, Impact Printer might best

be described as a note printer, rather than a page printer. It is excellent for jotting down things from the screen—when you find that your program works, you can simply add the OPEN4,4 and CMD4 commands at the beginning of the program, LIST and CLOSE4 at the end of the program, re-run it, and the whole thing will be saved on paper tape.

This Impact Printer is small, and it's much slower than a full-size dot-matrix machine, but it's a very serious little printer. *(Fidelity Electronics, Ltd., 8800 NW 36th St., Miami, FL 33178. $129.95.)*

G. Scott Wright
Albany, NY



C-64-Link

Upgrade Your C-64 With Features Found In PET/CBM Computers

Richvale Telecommunications offers a wide collection of products for the various Commodore systems. They are carried here in the United States by a number of distributors and dealers, and the few samples I've seen appear to be of high quality, with good documentation.

Richvale's most interesting product is the C-64-Link cartridge for the Commodore 64. It provides your C-64 with a number of characteristics and features normally found only on the more expensive PET/CBM series of microcomputers. Unlike other interface devices, the C-64-Link has no switches to set. It simply plugs into the cartridge port and provides Basic 4.0 features at power-up.

The C-64-Link gives you an IEEE-488 bus interface, so you can use any PET/CBM peripheral such as the 4040 and 8050 high-capacity disk drives. You can even intermix serial, parallel and IEEE peripherals, all connected to the C-64. Additional Basic commands are added to the operating system to allow selection of the peripheral interface you want to use.

Once the C-64-Link is installed, all you need is a standard PET-to-IEEE cable to connect the first IEEE peripheral. You can then use standard IEEE-to-IEEE cables to daisy-chain additional peripherals.

Special cables are also available. You can interface a parallel printer via the VL-3 cable, a standard RS-232 modem via the VL-4 cable, or a standard RS-232 series printer via the VL-8 cable. Each of these cables is connected to the Commodore 64's user port, and the C-64-Link provides the necessary support software.

Besides the additional interfaces, you also get a number of new Basic commands normally found in the PET and CBM systems' Basic 4.0. These include the 16 DOS commands for Header, Copy, Catalog, DOpen, DClose, Rename, Scratch and so on. You also get a built-in machine language monitor just as in the PET/CBM systems.

There's also a built-in modem program; nothing fancy, but it works. It will support the VICModem or an external standard RS-232 interface modem connected to the user port with the VL-4 cable. It simply makes the C-64 emulate a dumb terminal with no file transfer or printer output capabilities.

Relocator Program

A special relocator program is supplied on tape, along with an information program explaining various ways the cartridge can be used. The relocator allows combining disk and printer types, converting CBM ASCII characters to true ASCII for most parallel printers, and saving selected settings for the next time the relocator is used.

Keep in mind that when the C-64-Link is used, you lose 8K of Basic program space. This loss of memory space—or the difference in ROM software—may make the cartridge incompatible with some software packages. By relocating the C-64-Link software, you can usually overcome this drawback. The relocator program has six options as to where and how you relocate the C-64-Link software.

You can relocate it to start at $B000, under the Basic ROMs and invisible to the C-64 operating system. This only requires 512 bytes from Basic at $7E00, $8E00 or $9E00; or you can store it above Basic at $C000 or $CE00. Relocating to either area does not destroy any functionality of the C-64-Link.

Another relocation option is to copy the Basic and Kernal ROMs and then modify all serial and disk routines to support IEEE devices. The normal ROMs are then disabled to use the new routines. When this method is used, the

machine language monitor and Basic 4.0 features are no longer available.

Other relocation options allow flipping the C-64-Link in and out of the system or relocating it to an area compatible with the PET emulator program. Most of these options disable the machine language monitor and the Basic 4.0 commands.

If a program is not compatible with the C-64-Link cartridge, you can turn off the Link after loading the program, assuming the program does not use the disk. If it does, you'll have to load the relocator program first, relocate the C-64-Link software to an address appropriate for the desired program, and then load the program itself.

Having the IEEE-type disks on the Commodore 64 is really a pleasure when compared to the VIC-1541 serial interface drives. A 20K program takes about 40 seconds to load from the 1541 drive. The same program takes only about 10 seconds to load from a 4040 drive with the C-64-Link, or about the same time as on the PET. *(Richvale Telecommunications, 10610 Bayview Ave., Richmond Hill, Ontario, Canada L4C 3N8. $169.95.)*

Robert W. Baker
Atco, NJ

VIC-20 Expansion

This 32K Memory Card Is a Nice Fit for the VIC-20 Do-It-Yourselfer

Legend Valley has a different, more sensible approach to VIC-20 memory expansion.

The VIC-20 has 5K of RAM (random access memory); only 3.5K is available for programs. This is enough memory for simple programs, but most users eventually feel the need for more room.

RAM expander cartridges, available in various sizes, plug into the VIC's memory expansion port on the backside of the computer. To fill the VIC-20 with RAM up to its maximum capacity, you must use one 16K cartridge, one 8K cartridge and one 3K cartridge. Throw in an IEEE-488 unit, a cartridge game or two and a programmer's aid, and it's clear that the single memory expansion port on the VIC-20 can't hope to cope! Some sort of motherboard arrangement is needed to accommodate all of these at once.

The people at Legend Valley Computer Systems have opted for a different, and I feel, more sensible approach. Their new memory board, which is called the Legend Valley 32K RAM System for the VIC-20, mounts inside the VIC-20, leaving the memory expansion port free for other uses. Thanks to a clever interface method, which I'll describe shortly, and a flat circuit board arrangement, this system easily fits completely inside the VIC-20!

What the System Includes

As the name implies, this is a very full memory card. It actually contains 27K of RAM, and when this is added to the stock amount of 5K, the result is a 32K VIC-20. Note that under most conditions, this is the maximum amount of RAM that the VIC-20 is able to handle.

The basic idea, then, is that if you're going to add RAM to your computer, why not do it all at once and get it done with. There's hardly a program around that can't fit into 32K of RAM!

The Legend Valley system can be viewed as containing four memory blocks. There are three 8K chunks that fit in at the $2000–$3FFF region, $4000–$5FFF region and the $6000–$7FFF region, respectively. These three blocks span the area in your computer that is generally used for Basic program storage.

However, one nice touch is the inclusion of a 3K block, which fits in below Basic—at $0400 to $0FFF. This block can be very useful for storing machine language programs, among other things. So, three 8K blocks plus one 3K block add up to a total of 27K of RAM.

Many programs will work only if various types of expansions are in place. (This is because the start of Basic and screen memory can shift depending upon the amount of extra RAM in place.) For example, some games will only work on a stock machine, while others must have an 8K minimum of extra RAM added on. There are even some programs that will only work if a 3K expander is used, but not an 8K! As you can see, the situation is quite confusing.

To make it easy to cope with these different needs, the Legend Valley system includes bank switches, which allow you to selectively disable any of the four blocks of RAM. Instead of yanking cartridges in and out, you can simply throw a switch to configure the VIC-20 differently.

The physical aspects of this system are quite appealing. A single circuit board contains all the needed components and mounts with double-sided tape to the backside of the keyboard assembly inside the VIC-20. Next, you must replace the 6502 microprocessor chip with the Legend Valley system's special header plug.

Finally, you must top the 6502 microprocessor chip with the header plug. The header connection is sandwiched between the VIC-20 and the 6502 microprocessor and no soldering or other distasteful procedures are involved.

One final group of wires terminates in the four bank select switches, mentioned above. You may leave this switch assembly lying out the back of the VIC-20, or, with a little extra work, you may mount it on the computer's front surface.

The Test: Hooking It Up

The Legend Valley system was designed so that the owner can install the unit himself. The unit comes with two pages of instructions, which detail in eight steps the procedure to be followed for hooking up the unit.

I feel that the instructions are far too sketchy. A few pictures would have been helpful, especially with regard to orienting the special 6502 header connector.

Anyone who has ever handled ICs (integrated circuits) and IC sockets will at once recognize the notch key in the header and will be able to install the unit correctly. But since a fair amount of money is involved here, I think the user should have been flooded with sketches,

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pictures, descriptions or whatever it takes to ensure a safe and successful installation.

Installation of the actual circuit board is easy, using the double-sided foam tape provided with the product. I was a bit nervous about the screw heads on the back of the keyboard surface touching parts of the circuit board, so I covered a few spots on the back side of the board with some extra strips of electrician's tape. After seating the circuit board, and despite the somewhat obscure instructions, I then installed the 6502 header arrangement.

The final step is mounting the bank select switches. If you want to let the switch hang out the back, you won't disfigure the VIC-20 in any way. However, I chose to mount the switch to the front top of the VIC-20, right below the power-on LED.

To do this, I punched a small hole through the plastic case of the VIC-20 with a hot knife, and then enlarged and squared it up with a small flat file. Next, I drilled a hole large enough for a #4 bolt, slipped the switch through from the underside and finally bolted it in place. The results were very good and the switch looks just like it was supposed to be there!

This took about ten minutes to accomplish, and the only precaution was to take care that excess filings didn't fall into the VIC-20. And of course, I had placed the computer on a soft towel to prevent marring and scuffing.

All in all, installation went quite easily, but then again, I've had some experience in electronics. Total novices should turn the installation over to either a friend with more experience or to a friendly dealer.

Using the System and Final Comments

The system works great! One remarkable aspect is that it only draws 170 milliamps, which leads to a cool-running VIC-20. This is actually less current than some 16K cartridges need! And keeping all of that RAM inside the VIC-20, instead of cluttering up the memory expansion port, is an absolutely terrific idea. I have always detested cartridges and intended to never buy any extra RAM until someone designed this type of system.

Since I have a number of software packages that depend on certain amounts of RAM being installed, I really like being able to deselect the various memory blocks at will. Having the switches on the front surface of the VIC-20 is really slick, too.

While the instructions need to be beefed up with pictures and more explicit descriptions, I suspect that I received a test version of the instructions, since they were actually a computer printout. Perhaps Legend Valley provides newer and more explicit instructions now.

Apart from this, I rate the system excellent. The price seems fair, the circuit board is very nicely laid out and high-quality parts appear to have been used. With 32K of memory, I'm ready for some monster programs now! *(Legend Valley Computer Systems, 1474 Naughtingham, Newark, OH 43055. $129.95.)*

Thomas Henry
Mankato, MN

Circle 91 on Reader Service card.

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Games RUNdown

Compiled by Shawn Laflamme

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You can choose your level of command (platoon or squad leader). There are over 70 tanks to choose from—each tank is historically rated for armor thickness, strength, speed and fire accuracy.

Combat Leader is available on disk or cassette for the Commodore 64. It requires one joystick and costs $39.95. Strategic Simulations, Inc., 883 Stierlin Road, Bldg. A-200, Mountain View, CA 94043.

Check Reader Service number 437.

Which Way Out?

Wayout, from Sirius Software, Inc. (10364 Rockingham Drive, Sacramento, CA 95827), is a 3-D action maze game for the Commodore 64.

The game features 26 different mazes, each with its own set of quirks and challenges. Drifting Fireflies show you which way the wind is blowing—your only clue as to the direction of the exit. You must be on guard against the thieving Cleptangle, which tries to steal your compass and mapmaker.

Wayout is available on disk for $39.95.

Check Reader Service number 416.

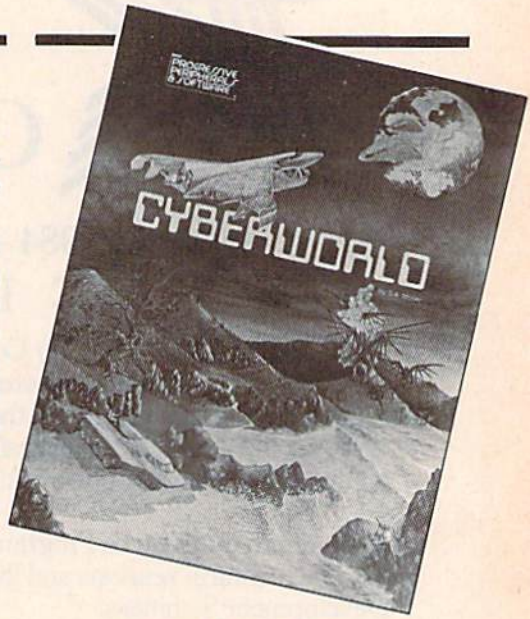
Mountain Madness

In Crisis Mountain, you control Kip Armstrong, a daring mine explorer who has stumbled onto hidden mountain treasures as well as traps, boulders, bombs and Bertram the belligerent bat.

When Kip safely reaches a bomb site, he must dig up the bomb and deactivate it. After deactivating the bombs, he is free to collect point-earning treasure and progress to another mountain filled with even more danger and treasure.

Crisis Mountain is available on cartridge for the Commodore 64 and the VIC-20. The C-64 version costs $34.95 and the VIC-20 version costs $29.95. Creative Software, 230 East Caribbean Drive, Sunnyvale, CA 94089.

Check Reader Service number 417.



Brave New Galaxy

Cyberworld, from Progressive Peripherals & Software (2186 South Holly, Suite 2, Denver, CO 80222), is a two-disk adventure game for the Commodore 64.

It is the year 2814. Earth has been devastated and abandoned. Your skills determine the fate of the planet Cyber, man's new refuge.

Your mission is comprised of three sub-adventures. You begin by hijacking a Drokon warship, then advance to a defense of Cyber against the Zaxxar invaders. Your final mission is to pilot a warship, clearing aliens from the Cyberworld galaxy.

Cyberworld is available on disk for $39.95.

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In Pooyan, you must rescue defenseless piglets from the mouths of hungry wolves. You glide up and down in your gondola, defending the piglets—but the vicious wolves, floating up and down from a tree with the aid of balloons, throw deadly acorns at your home.

A well-placed arrow will burst a wolf's balloon. Chunks of meat (your secret weapon) distract the cunning canines. A second scenario takes you into the wolves' lair.

Pooyan is available on disk or cassette for the Commodore 64. It costs $29.95. Datasoft, Inc., 9421 Winnetka Ave., Chatsworth, CA 91311.

Check Reader Service number 422.

Two from Tronix

Tronix Publishing, Inc. (8295 S. La Cienega Blvd., Inglewood, CA 90301) has introduced two adventure/strategy games for the Commodore 64.

In Waterline, you are a ship captain faced with a moral choice—you can either lead your helpless passengers to safety, or help yourself to the ship's gold. In Suicide Strike, you must maneuver your aircraft through waves of enemy planes and fire to reach your military target—time and fuel are running short.

Each game is available on disk for $34.95 or cartridge for $39.95.

Check Reader Service number 425.

Zaxxon

Zaxxon, from Synapse Software (5221 Central Ave., Richmond, CA 94804), is available for the Commodore 64.

Zaxxon is a space adventure game in which you are a pilot, climbing and diving in your aircraft, attacking the enemy. The enemy fights back with missiles and threatening gunfire. Awaiting you is the ultimate confrontation with the powerful armored robot. Zaxxon is available on disk or cassette for $34.95.

Check Reader Service number 420.

Go for the Gold!

Broderbund Software, Inc. (17 Paul Drive, San Rafael, CA 94903), has released Lode Runner for the Commodore 64 and the VIC-20.

In Lode Runner, you are a highly-trained Galactic Commando maneuvering through scene after scene—running, jumping, drilling passageways and outfoxing guards in an attempt to seize chests of gold hidden in the Bungeling Empire's secret underground treasury.

The C-64 version offers 150 game screens; the VIC-20 version has 24 screens. Lode Runner also has a game-generating feature that allows arcade game enthusiasts to create additional game screens.

Lode Runner for the C-64 costs $34.95 on disk and $39.95 on cartridge. The VIC-20 version is available on cartridge for $34.95.

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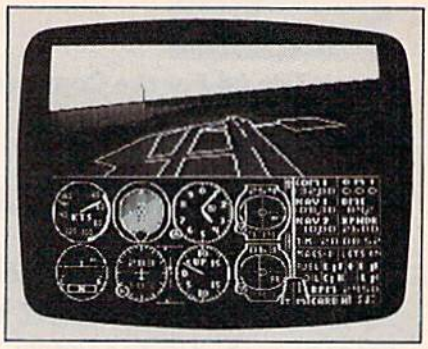

Takeoff!

Flight Simulator II puts you at the controls of a Piper 181 Cherokee Archer with full flight instrumentation and a panoramic view.

You can practice takeoffs, landings and complicated aerobatics. The program features over 80 airports in four scenery areas: New York, Chicago, Seattle and Los Angeles.

Three-dimensional color graphics provide a view of the outside world in either day, dusk or night flying modes. You can also adjust weather conditions. A World War I aerial battle game is included to test your flying skills.

Flight Simulator II is available on disk for the Commodore 64. It costs $49.95. SubLOGIC Corp., 713 Edgebrook Drive, Champaign, IL 61820.

Check Reader Service number 419.

River Chase and Galactic Battles

Cyberia, Inc. (PO Box 784, Ames, IA 50010) has released two new games for the Commodore 64.

River Chase challenges you to reach your home base via Xingu River. Your boat comes under attack by a fleet of deadly gunboats. You have to avoid running into obstacles in the river to keep your boat afloat.

Galactic Battles is the story of an explorer spaceship that accidentally enters a new universe. In search of the way back to its own world, the ship encounters hostile and fearsome creations of an ancient civilization. The game incorporates three different scenarios with a variety of aliens.

River Chase and Galactic Battles both require a joystick. They are available on disk for $19.95 each.

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R 384

Hardware RUNdown

Compiled by Shawn Laflamme

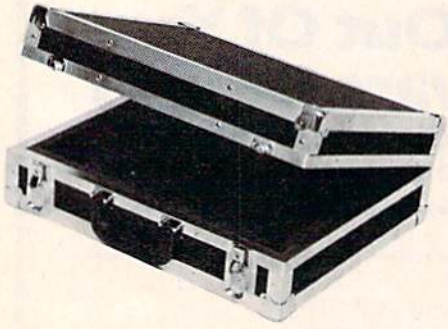
Impact Printers

Fidelity Electronics, Ltd. (8800 N.W. 36th St., Miami, FL 33178) has introduced the IMP-24 family of Impact Printers.

The printers use standard 2¼ inch adding machine roll paper, purple or black ink ribbons and print in a 5×8 dot matrix. They use upper- and lowercase ASCII characters and feature double width, double height and enlarged print.

The IMP-24 printers are compatible with Commodore computers. They cost $129.95.

Check Reader Service number 427.



A Case for Your Commodore

Computer Case Company (5650 Indian Mound Court, Columbus, OH 43213) has introduced the Trav-L-Case line of carrying cases for the long-distance traveler.

Constructed of heavy-duty materials, these cases can be used to transport Commodore computers. The cases have plywood sides covered with scuff-resistant vinyl, metal protection on the edges and covers, key draw bolt locks, padded handles and foam-padded interiors.

Prices range from $164 to $269.

Check Reader Service number 429.

Gain Access to CP/M Software

The Z-80 Video Pak is an integrated system for the Commodore 64, featuring a Z-80 microprocessor that gives you the ability to use CP/M software. The Pak includes Data 20's 80-column adapter.

The Z-80 microprocessor runs the SB-80 operating system. The SB-80 gives you access to CP/M programs. The 40-column Commodore version of CP/M will run on the Z-80 Video Pak. The 80-column cartridge creates its own character set for monochrome screen display. It also runs Commodore Basic in the 80-column mode.

The Z-80 Video Pak includes two software programs on disk: Word Manager and Plan Manager. Both come with Data 20's feature strip, which fits above the top row of keys for easy reference. The entire package costs $299.95. Data 20 Corp., 23011 Moulton Parkway, Suite B10, Laguna Hills, CA 92653.

Compro Modems

Compro Electronics, Inc. (3185-A Airway, Costa Mesa, CA 92626) has introduced three new Teledata modems, compatible with Commodore computers.

The Teledata 200 Basic Modem has manual Answer/Originate mode select and manual hookswitch control. It is powered by the phone line and requires no external power supply. It costs $69.95.

The Teledata 100 Messaging Modem works with all phone networks. It is programmed to answer all calls, records time and date and signs on and off automatically. It recovers after power failure and is equipped with a wall-mounted power supply. It costs $119.95.

The Teledata 300 Intelligent Modem functions with any phone network and standard voice phone lines. The direct phone line connect modem answers and dials out automatically. It is equipped with a wall-mounted power supply. It costs $189.95.

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Kleen Up Your Act

Electronic Specialists, Inc. (171 South Main St., PO Box 389, Natick, MA 01760) has introduced Kleen Line Modem protection. Models are available for 4 pin telephone modular connectors (RJ-11) and wider professional 8 pin connectors (RJ-45).

The Kleen Line system suppresses software-altering telephone and power line spikes caused by lightning, spherics or office phone switch gear.

Model PDS-45P-36A/SUP, modular 8 pin connector, costs $109.95.

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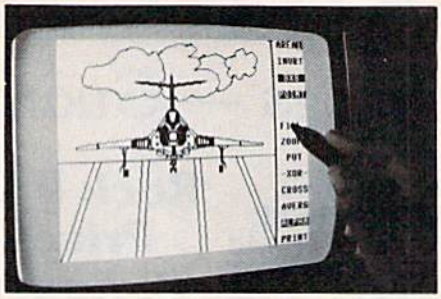

No More Pencil and Paper

Inkwell Systems (PO Box 85152 MB290, 7760 Vickers St., San Diego, CA 92138) has introduced a new light pen with its Flexidraw graphics software program for the Commodore 64.

With the Flexidraw light pen, you can produce a range of drawings from simple free-hand sketches to complex CAD-type drawings. The light pen will perform on standard TV sets as well as black and white, color and most green screen monitors. Screen response time is 175 nanoseconds with a two-line resolution capability.

All graphics generated with Flexidraw can be stored on disk or printed to hard copy. The Flexidraw package, with light pen and software, costs $149.95.

Check Reader Service number 433.

Bulletin Board News

Plumb is a newsletter for bulletin board enthusiasts. It reports on topics such as: online job-hunting systems; bulletin boards that contain online games and hints for beating popular computer games; conference boards for professionals; investment boards where traders exchange tips and strategies; and adult boards where callers can find dates and share intimate fantasies.

Each issue contains stories about hard-to-find "underground" bulletin boards. Plumbline, a regular feature, is a list of more than 120 bulletin board systems.

The subscription price for 1984 is $26.50 for eight issues. Riverside Data, Inc., PO Box 300, Harrods Creek, KY 40027.

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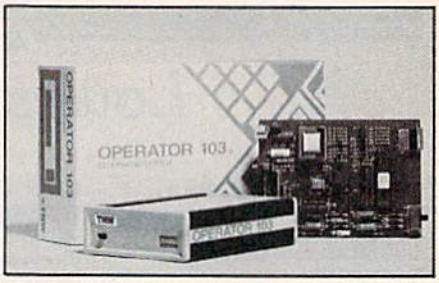

Who's Calling, Please?

TNW Corp. (3444 Hancock St., San Diego, CA 92110) has introduced the Operator 103 auto-dial/auto-answer modem.

The unit incorporates the command interpreter developed for TNW's Operator Automatic Calling Unit. Commands include: Dial, Answer and Hangup. You type only the first letter of the command, and the modem echoes the full command word.

Operator 103 provides normal and fast speed pulse dialing. It comes with a case, a power supply and a modular telephone cord. It costs $189.

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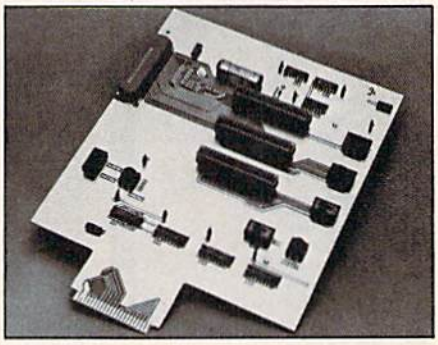

64 Expander

The 64 Expander (model EX-64OU) lets you add a variety of software and expansion peripherals to your Commodore 64.

The 64 Expander features one horizontal and three vertical expansion slots. The vertical slots provide ready access for insertion or removal of standard size cartridges. The horizontal slot permits large, bulky cards, such as an 80-column video converter, to rest safely on the table top. The expander also features a pause function and non-destructive system reset.

The 64 Expander is available for $79.95. Compuscope, Inc., 6400 Signal Road, Tillamook, OR 97141.

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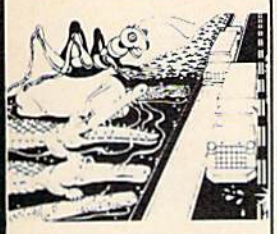
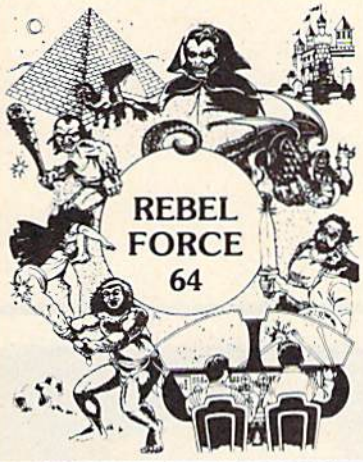


CRICKET

Software from ComputerMat will turn your VIC or 64 into a home arcade.



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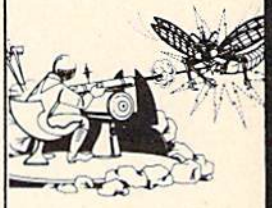

BUG BLAST

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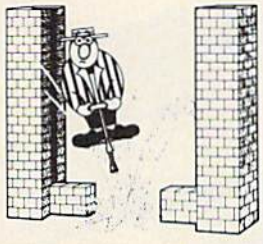

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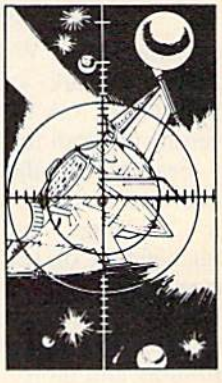
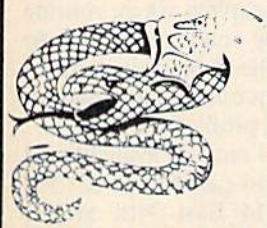
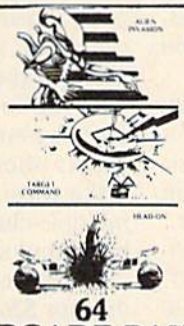


SPACE PAK



SNAKE OUT



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STOMPERS - 64

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SoftwareRUNdown

Compiled by Shawn Laflamme

Bank Street Writer

Bank Street Writer, from Broderbund Software, Inc. (17 Paul Drive, San Rafael, CA 94903), is a word processing program for the Commodore 64.

Features of the program include: universal search and replace, automatic centering and indent, inverse highlighting of text, word wrap, disk storage and retrieve functions with password protection, document chaining, inspection of page breaks prior to printing and more.

The program comes with a tutorial on the disk that teaches the basics of word processing. A back-up disk is also included.

Bank Street Writer is available on disk for the Commodore 64. It costs $69.95.

Check Reader Service number 414.

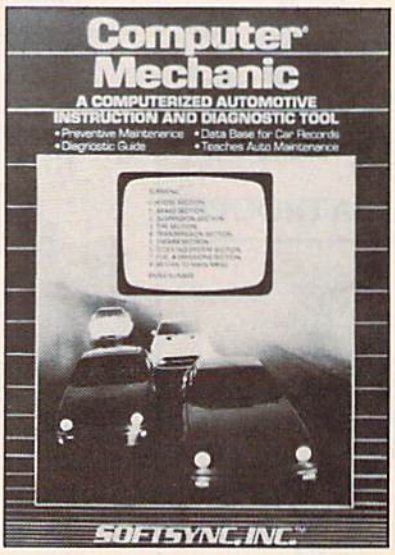
Totl.Business

Totl.Business is a set of accounting tools with integrated programs that automate record-keeping tasks. Functions and features are divided into two basic categories: accounts receivable and accounts payable. Accounts receivable contains invoice processing, customer statements, inventory control and complete tracking of accounts receivable. Accounts payable contains purchase order processing, check register and expense category tracking and complete accounts payable.

File size is limited only by the capacity of the disk; up to three disk drives can be used to allow maximum file size. The programs are menu-driven and work with any 80-column printer.

Totl.Business 3.6, for the Commodore 64, is available on disk for $95. Totl.Business 3.0, for the VIC-20 (minimum 24K memory expansion), is available on disk for $85. Totl Software, Inc., 1555 Third Ave., Walnut Creek, CA 94596.

Check Reader Service number 435.



Having Car Problems?

Computer Mechanic, for the Commodore 64, is an automotive instruction and diagnostic tool. It provides a maintenance file for one or a whole fleet of vehicles and helps you to diagnose problems when they break down.

The program can keep records on as many as 200 vehicles for each disk. Taxi companies, trucking firms and other businesses using company cars can keep watch on the maintenance needs of their vehicles.

If you're not mechanically inclined, the program can explain where routine checks should be made and how to make them. In the diagnostic section, multiple-choice questions are used to help you locate a problem.

Computer Mechanic is available on disk for $26.95 and cassette for $21.95. Softsync, Inc., 14 East 34th Street, New York, NY 10016.

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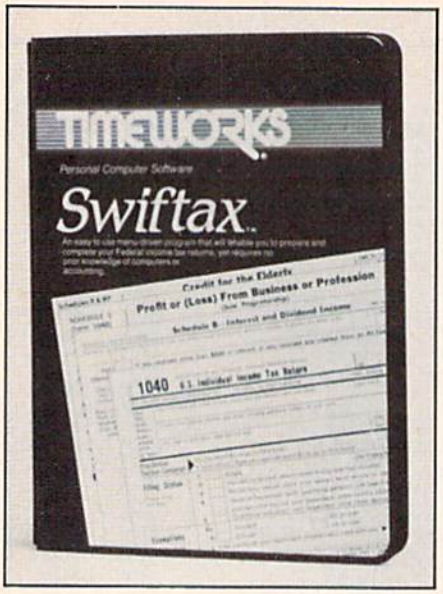


It's Almost Tax Time!

Swiftax is an income tax preparation program for the Commodore 64. It guides you through the tax preparation process and provides instructions on which forms you should complete.

The program checks tax alternatives automatically and calculates the lowest amount of tax that must be paid. It performs all calculations, including worksheets and entries from tax tables. It is available on disk for $49.95 from Timeworks, Inc., PO Box 321, Deerfield, IL 60015.

Check Reader Service number 402.

Learn Parts of Speech

Bertamax Inc. (3647 Stone Way North, Seattle, WA 98103) has introduced a Commodore 64 version of its Parts of Speech 1 Series for grade levels 3–6.

The series of programs is designed to provide practice in identifying parts of speech in a game-like setting. At level 3, the lessons involve nouns and verbs. At level 4, nouns and verbs are given in the context of a sentence. At level 5, nouns, verbs and adjectives are used in sentences, and at level 6, adverbs are also included.

There are ten lessons at each level. Words incorrectly identified are listed at the end of the lesson in a final report to the student.

The programs are available on disk for $39.50 per grade level.

Check Reader Service number 404.

Be a Smart ASCII

Smart ASCII Plus is a software interface for parallel printers. It allows keyboard graphics to be printed on most dot-addressable printers such as Epson FX-80, Okidata Microline 84 and Star Micronics Gemini-10.

There are six print modes, allowing you to print CBM graphics, convert control characters into text, print upper/lowercase for word processing and more.

Smart ASCII Plus is compatible with most applications programs. The package includes a connecting cable for your printer. It is available on disk or cassette for the Commodore 64 and the VIC-20. It costs $59.95. Midwest Micro, Inc., 311 West 72nd St., Kansas City, MO 64114.

Check Reader Service number 406.

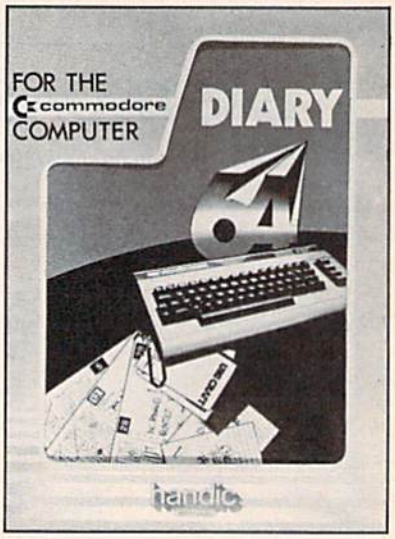
C-64 Database

PractiFile, a database program for the Commodore 64, is designed to help families, businesses and educators handle chores involving numbers and lists. Among its applications are inventory control, mailing lists, accounts receivable and tracking charge accounts or bank balances.

The program arranges and prints data for presentation in report form with titles and headings. It can handle over 1000 mailing list records on a 1541 disk drive.

PractiFile is available on disk for $55 from Computer Software Associates, Inc., 44 Oak St., The Silk Mill, Newton Upper Falls, MA 02164.

Check Reader Service number 400.



Dear Diary...

Diary 64 lets you keep track of telephone numbers, addresses, appointments, birthdays, business schedules and many other things that you need to remember. You can retrieve information through the database created on disk or cassette.

The program works similar to a notebook with pages appearing on the screen in block form. The Diary's block consists of ten lines with 27 characters on each line. Using the entire block as a key, you can segregate any combination of characters or any single character within a given block.

Diary 64 is available on cartridge for the Commodore 64. It costs $29.95. Handic Software, Inc., 5090 Central Highway, Suite 7, Pennsauken, NJ 08110.

Check Reader Service number 410.

Create Charts Without Programming

Chartpak-64, from Abacus Software (PO Box 7211, Grand Rapids, MI 49510), lets you create charts and high-resolution graphics without any programming.

You control the scaling, labeling and positioning of the chart on your screen. You can choose from eight different chart formats. If you don't like the initial results, you can change the format and build another chart.

Chartpak-64 is available on disk for the Commodore 64. It costs $42.95.

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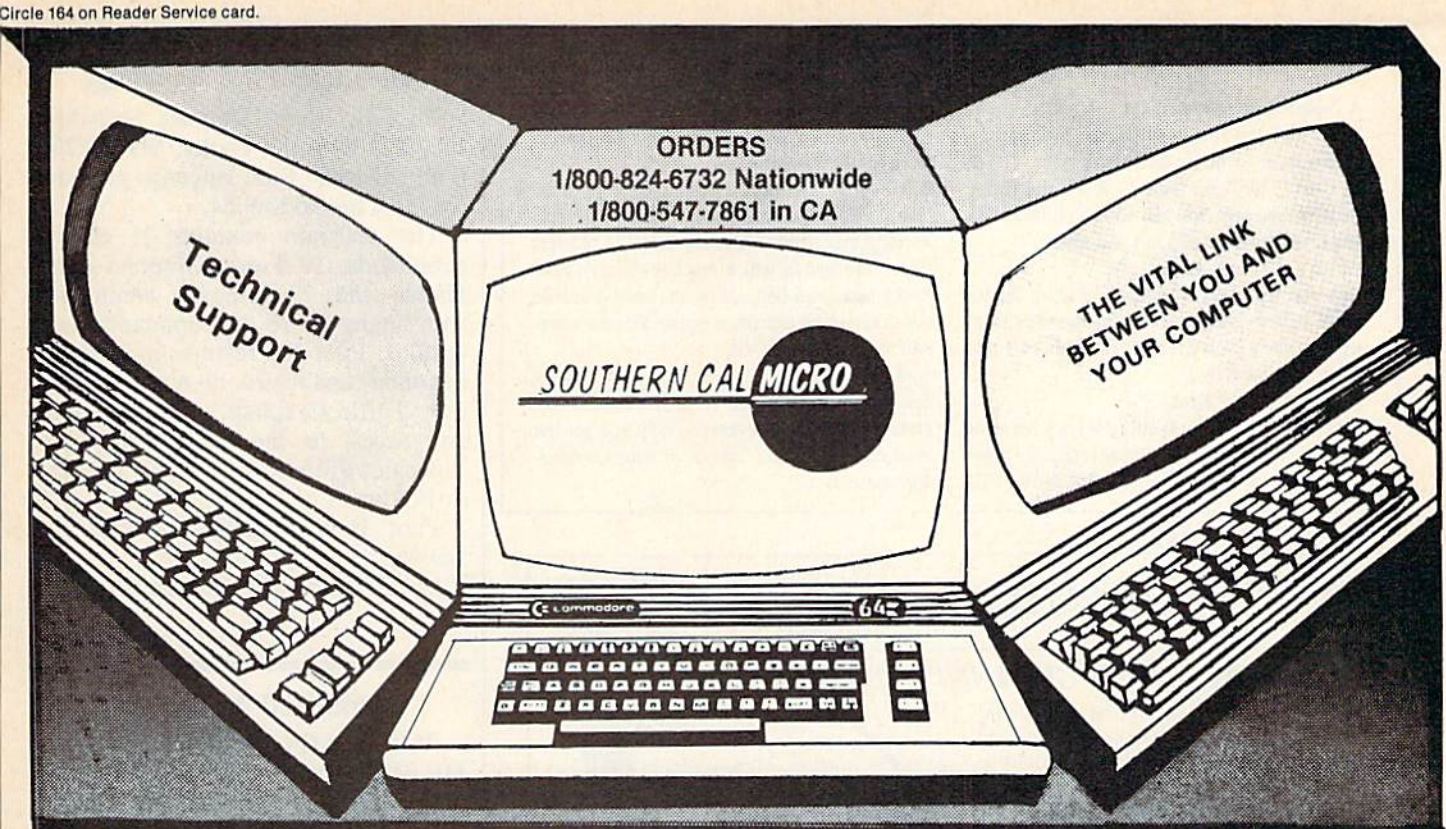

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Coming Next Month

A Noteworthy Article...
You don't have to be an expert programmer or musician to make noise with your VIC-20 or C-64. The April issue of *RUN* will review major music packages and show you how these machines synthesize sound and music.

"You're Getting Sleepy..."
Can you really be hypnotized by your micro? Well, believe it or not, in next month's issue, we will take a look at a C-64 program that purports to do just that.

A Sight for Sore Eyes...
Roving reporter Tom Benford is back home on the east coast—a little bleary-eyed, but none the worse for wear, after his visit to the CES Show in Las Vegas. He'll give us an insightful look at the new products and announcements disclosed at the show.

A Timely Program...
"Stop the Clock" promises to be an enjoyable learning experience for youngsters and oldsters alike. This game, which teaches children how to tell time, can be used by the teacher in the classroom or by parents at home. For the unexpanded VIC-20 or C-64.

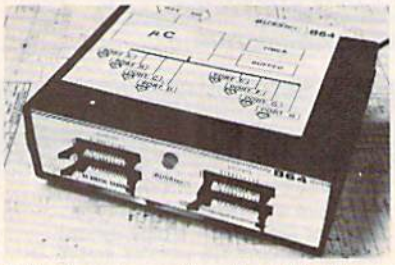
And More...
The April issue will also bring you regular columns, features and reviews to help you get the most enjoyment and use out of your Commodore system.

Circle 182 on Reader Service card.

BUSSter™ COMPUTER INTERFACES

IEEE — 488
RS — 232

ANALOG AND DIGITAL INPUT/OUTPUT MODULES



The BUSSter line of analog and digital products was designed to collect data and to output signals to laboratory and industrial equipment in conjunction with a microcomputer system. These powerful self-contained modules reduce a computer's workload by providing read or write operations to external devices. They are controlled as slave interfaces to real-world physical applications. Control is over an IEEE-488 (GPIB) bus or RS-232 port. BUSSter modules are available in several digital and analog configurations. The internal buffer and timer provide flexibility by allowing the BUSSter to collect data while the host computer is busy with other tasks.

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Advanced Pilot Language

Pilot II, from Tamarack Software, Inc. (PO Box 247, Darby, MT 59829), is an advanced Pilot language program for the Commodore 64.

The program contains 25 editing commands, 19 Turtle Graphics commands and 23 program commands with many more subcommands and options. Pilot II's features include file handling capabilities, hi- and lo-resolution Turtle Graphics, a sprite editor and access to the color and sound capacities of the C-64 without Peeking or Poking.

Pilot II is available on disk for $49.95.

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Animated Arithmetic

PMI Inc. (PO Box 87, Buckfield, ME 04220) has introduced a new educational game for the VIC-20.

Animated Arithmetic teaches addition using color graphics. It is designed for young children and pupils in remedial classes.

The package consists of two programs: Clown Count teaches children to count by asking them to count the number of boxes the clown is holding; Addition Express teaches addition using express trains traveling along number lines.

Animated Arithmetic is available on disk or cassette for $10.95.

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Comp-U-Check is a checkwriting and accounts servicing package, designed for personal or small business applications.

The package provides checkwriting, check account balancing, credit account management, letter writing, automatic bill paying, form letters and more.

Comp-U-Check is available for the Commodore 64 with disk. It costs $64.95. Hot Data Software Development, 1021 Lincoln Blvd., Santa Monica, CA 90403.

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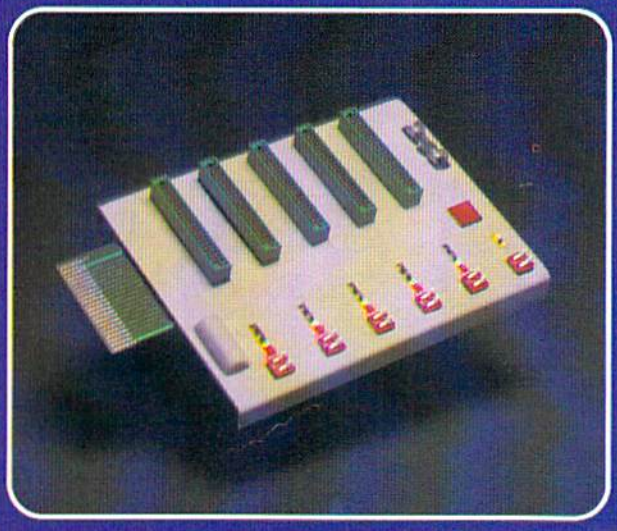

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